S. HRG. 98–724
PART 6

# DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1985

## HEARINGS

BEFORE THE

## COMMITTEE ON ARMED SERVICES
## UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

SECOND SESSION

ON

**S. 2414**

TO AUTHORIZE APPROPRIATIONS FOR FISCAL YEAR 1985 FOR THE ARMED FORCES FOR PROCUREMENT, FOR RESEARCH, DEVELOPMENT, TEST, AND EVALUATION, FOR OPERATION AND MAINTENANCE, AND FOR WORKING CAPITAL FUNDS, TO PRESCRIBE PERSONNEL STRENGTH FOR SUCH FISCAL YEAR FOR THE ARMED FORCES AND FOR CIVILIAN EMPLOYEES OF THE DEPARTMENT OF DEFENSE, AND FOR OTHER PURPOSES

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**PART 6**

**STRATEGIC DEFENSE INITIATIVE**

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MARCH 8, 22, APRIL 24, 1984

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# DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1985

THURSDAY, MARCH 8, 1984

U.S. SENATE,
COMMITTEE ON ARMED SERVICES,
*Washington, DC.*

## STRATEGIC DEFENSE INITIATIVE

The committee met in executive session, pursuant to notice, at 10:02 a.m., in room SR-222, Russell Senate Office Building, Senator Barry Goldwater presiding.

Present: Senators Goldwater, Warner, Cohen, Quayle, Wilson, Nunn, Stennis, Kennedy, Bingaman, and Dixon.

Staff present: Robert F. Bott and William E. Hoehn, Jr., professional staff members; Arnold L. Punaro, staff director for the minority; Brenda K. Hudson, assistant chief clerk; Douglas R. Graham, research assistant; and Karen A. Love, staff assistant.

Also present: Gerald J. Smith, assistant to Senator Goldwater; Les Brownlee, assistant to Senator Warner; Robert Savitt, assistant to Senator Cohen; Bernard R. Toon, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson; Francis J. Sullivan, assistant to Senator Stennis; Jeffrey B. Subko, assistant to Senator Exon; Matthew H. Murray and James Steinberg, assistants to Senator Kennedy; and Edward McGaffigan, Jr., assistant to Senator Bingaman.

### OPENING STATEMENT BY SENATOR BARRY GOLDWATER, PRESIDING

Senator GOLDWATER. The Armed Services Committee convenes this morning to receive testimony on the President's strategic defense initiative.

Senator Tower regrets that he is not able to be with us this morning.

I welcome our witnesses: Dr. Richard DeLauer, the Under Secretary of Defense for Research and Engineering, and Dr. Fred Ikle, the Under Secretary of Defense for Policy. We are pleased to have you with us this morning.

We begin in executive session to receive a briefing on Soviet activities in the area of strategic defense and to provide our witnesses and our members the opportunity to deal with classified matters.

It is Senator Tower's desire to go into open session as soon as we can. After that I will have a more formal statement. I am not a great believer in open sessions. So, we may not have one.

Gentlemen, if you have prepared statements you would like to make part of the record, we will do so.

Dr. DeLauer. I want to introduce Dr. Cooper, who is with us today, and [deleted] who is going to present the intelligence briefing.

I know that for myself I would like to have my statement, both the classified and unclassified, submitted for the record.

Senator Goldwater. Thank you.

Dr. Ikle. I have only an unclassified statement, Mr. Chairman.

Dr. DeLauer. With that, Mr. Chairman, why don't we proceed.

Senator Goldwater. All right.

[Deleted.]

Dr. DeLauer. Mr. Chairman, let Bob tell you a little bit about what we have been doing in power supplies, and there is no reason to believe that they are not equally as far along on at least the technology.

Whether they have deployed a more engineered capability than we have is a matter of speculation, but not the basic MHD technology.

## STATEMENT OF DR. ROBERT COOPER, DIRECTOR OF DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Dr. Cooper. There are two basic issues.

One is the prime power needed to drive large lasers. That falls into two categories: Lasers that have their own power-generating capability such as chemical lasers they have been developing.

There it is just a matter of fuel and having fuel efficiency in the lasers. Our programs have been aimed at very high fuel efficiency and we have been able to achieve designs that should be highly efficient, capable perhaps of being able with current launch vehicles to put lasers in space that could operate throughout the entire engagement time for a ballistic missile engagement.

The Soviets have tended to focus their attention on [deleted].

We have not placed as much emphasis on that [deleted].

We have concentrated more of our effort on chemical lasers. I would say on balance we are meeting our needs for power sources for our laser [deleted].

Senator Warner. At this point you could explain the transition that we are presently contemplating in our approach to this from a certain wavelength to another wavelength. This is a major issue before this committee this year.

Dr. Cooper. That is true. You are referring to the fact that we are shifting our emphasis in our program to a certain extent to short-wavelength lasers and particle beam weapons.

Both of these particular kinds of weapons will require advanced power systems. We are beginning to work on some advanced power systems.

For instance, last year we instituted a space nuclear power program with the Department of Energy and with NASA using nuclear reactor power systems.

We intend to qualify a 100-kilowatt space nuclear power system by the early 1990's and to investigate the capability to go to tens of megawatts of prime power in space in the not too distant future beyond that period of time.

So, we have programs that are now just being formed that we hope will meet the requirements for some of these advanced short-wavelength and particle beam weapon systems.

Senator WARNER. One criticism which has been brought to the attention of the committee is that we are abruptly terminating the progress we have made in the long-wavelength system before we have reaped from that effort the full benefit of knowledge.

We are canceling that prematurely, thereby precluding gaining from our investment.

Dr. COOPER. That is not correct. Our plans are to continue to pursue the advanced chemical laser technology at about the pace that we have been pursuing in the recent past with our same goals, that is the goal to determine the feasibility of those large systems [deleted].

Dr. DELAUER. We did terminate the Sea-Lite program which was a chemical laser program that was really being pursued as an option to be deployed aboard ship for close-in support.

That has been terminated by direction of Congress and the equipment is being used for an experimental and technology program at White Sands.

We are in the process of moving the pointer-tracker from Hughes Aircraft Corp. to White Sands, and will probably have to ask permission to provide some funds to be able to put it in and install it, which is not now in our 1984 budget.

Senator GOLDWATER. At Kirtland we have been able to develop the ability to hit targets I believe up to [deleted].

What would be the level of laser power needed to destroy current missiles incoming?

Dr. COOPER. Sir, the system that you are referring to is really installed on the airborne laser laboratory that the Air Force has been working with.

The performance parameter for that system is designated as a certain level. We believe that the [deleted] level to be able to perform some ballistic missile capability in space is about [deleted].

That is a [deleted] the fundamental performance parameter of that system. We believe that the technology program that I mentioned to Senator Warner a few moments ago should demonstrate the capability to build systems in space that have [deleted].

Senator GOLDWATER. Do you think we are capable of producing them?

Dr. COOPER. We have every confidence that [deleted] we will have demonstrated all of the key technologies that will be required to put together a system that will achieve that sort of [deleted] capability in space.

I must point out that the Fletcher committee in its studies last summer determined that to have a robust system against a responsive threat would require an additional factor of [deleted]. That is about a [deleted] upgrade from what the Air Force has demonstrated for a robust capability that would probably not be defeated by countermeasures.

So, there is some uncertainty within the technical community about what capability would be required in our new research program.

The 1985 research program will deal with the issues that will resolve how much additional performance beyond the [deleted] level that I mentioned previously will be required to have a robust ABM capability using directed energy weapons.

Senator GOLDWATER. Dr. DeLauer, based on the old "1-to-10 scale," where do you place this system in the importance of your work?

Dr. DeLauer. In our work?

Senator Goldwater. Yes.

Dr. DeLauer. [Deleted]. It has to be up there with the strategic modernization, with the improved tactical forces and the development work for this. [Deleted.]

So, it has to be within the top [deleted] initiatives.

Also, clearly a Presidential initiative, which in itself provides a level of importance that a normal research and development program at this state of technology would not have the focus. It does. That is why we are here.

Certainly the time we are spending with you this morning implies to a certain degree both the importance on our side and the importance you in Congress feel about the oversight of it. It is not a low priority effort.

Senator Goldwater. It ought to be very high.

Senator Bingaman. Mr. Chairman, I was going to ask Dr. DeLauer and Dr. Cooper if they could be a little more precise about what capability we are going to have [deleted].

I was under the impression that the long-wavelength chemical laser requires a very large optical capability and you have to have essentially a football field in the sky in order to get what you need in order to do much damage.

I was also under the impression that we did not have in the near future the likelihood of having anything that could inflict significant damage in a quick enough period of time to avoid the countermeasures that would obviously be taken.

Is that wrong?

Dr. Cooper. Let me answer specifically, Senator Bingaman, your question about what we will have [deleted].

What we will have [deleted] is knowledge that will tell us whether we can have this [deleted] capability that I mentioned before.

Now, that knowledge comes mainly from four programs that we have ongoing.

One program will actually build and demonstrate in a vacuum chamber on the ground a laser that is in the [deleted] category, chemical laser with very high fuel efficiency, one that could be a technology basis for a system of the future.

The second thing that we will have demonstrated is a space experiment [deleted] which will demonstrate that we can aim a laser in space at an object [deleted].

Third, we will demonstrate in a vacuum chamber on the ground a segmented optical system that is diffraction limited in the wavelength region that a chemical laser would operate in [deleted].

We will also demonstrate an ability to scale that to [deleted] for a system.

If we are able to do all of these things and to provide supporting research and technology from the fourth element of our program that underpins all of this and we believe we can do this [deleted] then we will be at a point where we have enough engineering control of the technology to decide whether to build a system that can be put in space as an experiment, a feasibility demonstration or validation experiment.

We have not decided whether we should do that or not. We don't know what the outcome of our research will be, but we have high confidence at this stage that we will be able to conquer all the substantial technical problems in each of the three areas I mentioned by doing the experiments that we have planned.

Senator NUNN. May I ask one question at this point?

How much money are we going to expend [deleted] to reach that threshold of decisionmaking that you have just described?

Dr. DELAUER. Right now what we have firmed is what we are here to discuss, which is essentially $2 billion for these efforts.

Senator NUNN. $2 billion over the total?

Dr. DELAUER. Fiscal year 1985.

In the present planning we are doing for fiscal year 1986, we are going to have about $3.8 billion in the Department of Defense and about $290 million in the Department of Energy.

Over the full period from 1986 to 1989 at the present time we feel it will be around $23 billion.

Senator NUNN. In addition to $2 billion?

Dr. DELAUER. That is right. It is in addition to the $4 billion I talked about for 1986; 1986 through 1989 is about $22 billion in the present planning and the Department of Energy will have about $1.8 billion.

Senator NUNN. That is for the whole program; is that right?

Dr. DELAUER. That is the program we now have.

Senator NUNN. What about what Dr. Cooper just talked about, to get to the point we are going to start the experiments?

Dr. DELAUER. That is the Alpha laser, the Lode and the Talon Gold. Those are the code names for that. It is about $750 million.

Senator NUNN. For the whole timeframe?

Dr. DELAUER. That is right.

Dr. COOPER. For the things I described.

Dr. DELAUER. $750 million.

Senator GOLDWATER. That includes money for chemicals?

Dr. DELAUER. The Alpha laser is a chemical laser.

Senator GOLDWATER. You are not going to deemphasize the chemical laser?

Dr. DELAUER. Not for this experiment; no, sir.

Senator GOLDWATER. They both will proceed together?

Dr. DELAUER. That is right. The triad, as we call it, is a chemical laser. In fact, my old outfit built it.

Senator WARNER. Assuming Congress goes along with the request, what will be the comparability between the capability of the United States and Soviet Union in the 1988–1990 timeframe?

Where will we be in terms of their progress?

Dr. DELAUER. I can tell you where we will be. We will be about [deleted] along the road to be able to deploy this because our view is that while certain of these portions of these systems will be able to be deployed in a decade, it is clear that full deployment of a concept that we are talking about, essentially a layered ABM system, is a 20- to 25-year proposition.

How fast the Soviets will be after it depends a little bit on how successful they are with the work they are doing in the next few years

and what the complications are from transitioning from technology into a deployed system.

They are pretty good about continuing their effort, but it takes some time to transition. I can't give you a quantitative effort.

Senator WARNER. We are given the impression by intelligence briefing that we are [deleted].

Dr. DELAUER. Absolutely. They will have something deployed [deleted]. We have been saying that for years.

People have been trying to force me to say they will have something [deleted].

Senator WARNER. At what point do we begin to move in tandem, parallel, or rough equivalence?

Dr. DELAUER. [Deleted.] Our progress is about the same.

You know, in a decade we will have spent maybe $40 billion by that time through 1990–1991. At that time we will have something [deleted].

Senator WARNER. The short answer is that we are [deleted].

Dr. DELAUER. That is right, at these levels. We are not proposing to change any options at this time. We may when we get through the next 2 or 3 years.

The options are going to be for future administrations. Let us make it clear.

Senator WARNER. Is it the duty of this President to do the research, to give options to a future President with respect to any deployment?

Dr. DELAUER. That is right.

Senator COHEN. Last month Secretary Weinberger indicated that the objective of the President's Star Wars proposal is to "protect our people against nuclear weapons, and have an absolute and effective defense against them."

I would like to get your comment concerning the statement in today's Washington Post about the so-called Hoffman study, which indicated that it may prove unattainable, but nevertheless, we should go forward with something that we can do in a relatively short period of time with a limited ABM system.

I would like to have your comment. Should we be going back to the ABM system that we rejected in the seventies?

Dr. IKLE. If the goal is a fully effective system, on the basis of the next few years of R&D development, we can map out specific options that would move toward deployment, and if the next administration takes the decision, it stands to reason that as you move toward deployment of the full system that this does not derive overnight, but there are some intermediate steps which have intermediate utility.

That is quite important, particularly in the competition that Senator Warner highlighted, in that the Soviets have been moving ahead. [Deleted.]

Senator COHEN. If you were a Soviet planner and you were moving toward deloyment of an ABM system similar to what we had in the seventies, how would you overcome that?

What would be your method of overcoming that?

Dr. DELAUER. This is a hypothetical situation.

One of the things I would be concerned about is the cost effectiveness of essentially a reactive situation. In most defensive-offensive challenges there is no question the proliferation is probably the first thing that you can do to overwhelm a defensive system.

The question is, is that cost effective?

First, I would look at proliferation. As was discussed earlier, I would look at proliferation in decoys; they are cheaper.

Then I have to look at the full spectrum of where they are going to be.

The characteristics of this program are that the focus on the boost midcourse phase of the situation says that decoys that have been deployed, in other words, have been boosted out and now are reentry vehicles or replicas of reentry vehicles can be discriminated against. That is why we are putting the money in this area.

The question of boost stage is a question of whether or not you are willing to put in investment as to proliferation of boosters.

There is no question, one of the things that Fred has testified and we have testified to your subcommittee in December, Senator, that part and parcel of all this is realistic arms control.

Senator COHEN. Let me quote something said 15 years ago by Dr. John Foster. He said: "We are developing * * * MIRV payloads as a way to ensure our ability to penetrate Soviet defenses."

Dr. DELAUER. That is right.

Senator COHEN. It seems to me the statement applies the other way as well. If we start building ABM sites to protect our missiles, the first thing they will do is simply increase their MIRV capability.

We are trying in the arms control proposals to reduce the MIRV'ing.

What we are doing here by recommending going to ABM is to encourage them to start MIRV'ing more.

Dr. DELAUER. As a planner, I would have to have the following kinds of things to be concerned about: Am I going to make investment in the MIRV'ed system, further investment in a MIRV'ed system, if indeed the opposition could have the capability in the time I am doing that to get me before I deploy?

In other words, a MIRV'ed system, the challenge to a MIRV'ed system, is the fact you use a single booster for many objects. If I can get those things before they are deployed with a defensive system, then essentially the cost-benefit ratio is well on my side.

That is the whole emphasis on trying to get the boost-phase defense. In that case the MIRV'ed system is the opposite thing you want to do.

Senator NUNN. Don't you mean the first one to deploy?

Dr. DELAUER. Yes. I used the question of deployment in a MIRV'ed, not on the ground.

Senator COHEN. Are you saying we would get an ABM system in place before they could increase their MIRV capability?

Dr. DELAUER. No. As a planner, it takes time and money to get a modification in. That ought to have some kind of half-life that really pays for the thing.

Dr. COOPER. What he is saying is that if you can shoot in the boost phase, MIRV'ing is irrelevant. He can MIRV all day, put a thousand RV's on one launch vehicle, and that would be great for you because you just shoot that launch vehicle, and those thousand RV's are dead.

MIRV'ing is irrelevant if you can engage the target in the boost phase. That is what is different from 1968.

Senator COHEN. The current ABM's that Hoffman is talking about have the capability of getting at the boost phase?

Dr. COOPER. No, we are talking about a research program that will get us that capability or not, depending on how successful we are.

Dr. DELAUER. Let me address the Hoffman situation.

Hoffman conducted a study focused on policy issues. We were looking at essentially the complete regime of defense. One is essentially the atmospheric terminal defense as we loosely call it.

The other was a midcourse defense and the other was a boost phase.

That is what we keep presenting as essentially the layered defense concept.

The terminal phase is one we have done the most work on, and which Hoffman claims we are further ahead on, and which essentially used the capability that is analogous to what the Soviets have.

In other words, their GALOSH's and our SPRINT's, sources of kinetic energy, describe types of defense missile systems Hoffman says we are further ahead with. If you want to have a near-term deployment, his report, which he gave to the Fletcher committee, said this is the one that will probably have some capability soon.

Whether it is the one to do first or not is what we are trying to find out. You will see that, for instance, in our budget, just to give you an idea——

Senator COHEN. Would it be effective against more MIRV'ing?

Dr. DELAUER. Actually, it can. It would not be effective against decoys.

Senator COHEN. If we make that determination as one of your recommendations, if that is a recommendation, does that not have to be taken into account where we are trying to force the Soviets to go away from MIRV'ing?

Dr. IKLE. You are discussing something here which is not a hypothesis, let alone planned.

The study that Fletcher-Hoffman looked at is one of the problems of transition. The scientists who have looked at phasing in a world where both sides have defenses, make an instability of conditions, because the Soviets come along with a defense that you have been briefed on, and it may come sooner, and as we move in the multilayered defense and make decisions to start deploying it, if we do make decisions based on our future research, it is inevitable that there is some partial capability emerging.

We are talking about the partial capability of the Soviet side emerging. The question is very serious instability. That is what was mentioned in the Hoffman report.

It could create instability that we have been, starting in the 1970's, trying to move the Soviets into more MIRV'ing.

On the other hand, where multitier systems are coming down the pike, this would be the worst investment the Soviets could make.

In addition, some of the partial capabilities if they MIRV on our side, this is what the report was talking about, are not necessarily all that bad because they complicate the Soviets' effort.

Senator WILSON. Is it not more likely, in your view, if you were a Soviet planner, are you not going to be encouraged, not so much to go further MIRV'ing, as to increase your decoys?

Dr. DELAUER. That is the first thing I would do, go into [deleted].

The SA–12 is really an anti-Pershing system. It is mobile as the Pershing is mobile. It is for a system that has essentially that kind of performance, [deleted].

There are other things you can do. As a matter of fact, in some cases on the kinetic energy type of ABM, one of the things that you will probably do as a Soviet planner, first, is essentially to have a maneuvering missile.

Again, you have to be careful what you are buying with it. You are going to lose accuracy. You will increase the fact that more of your warheads will impact, but you may not have the accuracy that you need.

That is why you can't look at this thing in essentially a focused way. You have to look at it in a broad spectrum of whole strategic defense.

We are not buying a warfighting machine. We are building a nonwarfighting machine which is strategic defense.

What that gives you is a greater degree of survivability. That is an inherent part of defense, how much of your assets are survivable.

Senator WARNER. Mr. Chairman, if I might suggest, could Dr. Ikle be given an opportunity to give his direct presentation? Maybe the Chair will consider a portion of this hearing open, because we are going to have to defend this program on the floor and in public. I think it would be helpful.

Senator GOLDWATER. Have you finished with your global assessment?

Dr. DELAUER. Yes, sir. It is mostly the intelligence. Both Fred and I have unclassified statements. I will just run through mine to provide a basis for questions, but it can be an open session.

Senator GOLDWATER. Is there any objection?

Senator BINGAMAN. I have one question that maybe should be asked in closed session.

This Talon Gold program that you are talking about testing in space in [deleted] as I understand it, will that violate the ABM Treaty?

Dr. COOPER. No, sir. It will not. It has nothing to do with weapons or components of weapons systems. It is strictly an experiment. It only will prove a variety of technologies that will be combined in that system.

Dr. DELAUER. Why don't you give a rundown of the triad?

Dr. COOPER. Basically I can cover that.

In the Talon Gold area the issues that are going to be resolved there are issues of stability of an optical system attached to a platform like the Space Shuttle and being able to stabilize an optical line of sight over [deleted] or more to [deleted].

Those are classified goals or objectives of this technology. The technology is multiuse. That same technology could be used in an advanced surveillance system, for instance, or reconnaissance system of an advanced type.

So, consequently, it is just the technology demonstration. It has a number of potential applications among which would be the laser weapon in space application, but it is a generic technology.

Senator BINGAMAN. In all that you are planning in the next 5 years, you don't see any of that as arguably a violation of the ABM Treaty?

Dr. DELAUER. In my statement, and I will make it now and not later, there is nothing in our program that violates the existing treaty.

Senator QUAYLE. You said that for the Soviet planner it would be the worst decision to put these into a MIRV'ed warhead because the assumption is that we would potentially get them at the boost phase.

Is that correct?

Dr. DeLauer. Yes.

Senator Quayle. If so, don't you have something like 50 seconds in the boost phase?

If that is the case, where is the human intervention?

Dr. Ikle. If the decision has been made to go ahead with the multilayered system and research that Dr. DeLauer elaborated on has resulted in a plan for phased deployment, and if in that case the Soviets try to overcome initial part of that phased deployment, they would be wasting that money, as Dr. Cooper explained.

Senator Cohen. What if we never get to the potentials in the boost phase?

What if you take the first step and go to limited deployment of your ABM system, giving them the incentive to go to more MIRV'ing, and you never get to your laser?

You won't be here 10 years from now or 8 years from now. You don't know what Congress is going to do.

Isn't that part of the problem?

Senator Quayle. The problem is getting them in the boost phase.

Dr. DeLauer. It is not an either/or. If they proliferate their existing booster capability by fractionating even further, which we discussed and we talked about, the yields have to come down. They have just so much booster. If they want to build a bigger booster, they can MIRV now on the SS–18, [deleted].

The accuracy does matter. It is essentially the booster and [deleted] the accuracy for each of the things depend on its range and this sort of thing. It is immaterial. It is just the payload capacity. [Deleted]. If you want to fractionate any further than that, yields are going to come down. They may not want to do that.

They have been very careful [deleted].

Senator Cohen. You and we can't guarantee what they are going to do. We ought to try to think out in advance before we take one step, what the consequences are if we don't follow through on that.

Dr. DeLauer. Let me give you another concept. This is probably the cheapest deterrent money we can spend. You can do things to cause deterrent R&D. I have been arguing that for years, by doing multiple things in R&D, you are going to force him to do, you are reacting like a planner, he will have either/or or both.

Senator Cohen. I am not questioning the R&D.

Dr. DeLauer. I am saying his reaction has to be very considered. If he attempts to cover the waterfront for your eventuality, it will be very expensive for him. It slows down his deployment. He has to look at more things.

To a degree, that should be some of our initiative that gets him to the point where he sits down and cuts the numbers down.

Senator Quayle. What is the time on the boost phase?

Dr. Cooper. Three hundred seconds. It is another 300 or 400 seconds for a postboost vehicle.

Senator Quayle. How much further can the Soviets reduce the 300 seconds?

I have been told that with a minimal effort they can reduce it down to 50 seconds.

Dr. DeLauer. You can reduce the payload. Our Sprint system is very, very fast, but it has a very small payload.

You are just going to have to put the energy into the booster to be sure that if you are going to burn out very low, you have to make it burn very fast because the amount of energy with a certain payload to go 6,000 miles is the same no matter whether you do it fast or slow.

Senator QUAYLE. If in fact they can reduce it, and if it gets down closer to 50, do we have a question of time before we decide to respond?

Dr. DELAUER. Yes. There is even a tougher question that we have to look at.

Can you get up out of the atmosphere?

If you burn well within the atmosphere, it eliminates some of the kill mechanism we have there.

Senator GOLDWATER. We are going to have to move along if we are going to finish this hearing.

Without objection, the committee will go to open session.

## OPEN SESSION

Whereupon, at 11:18 a.m., the committee proceeded in open session.

### STATEMENT BY SENATOR GOLDWATER, PRESIDING

Senator GOLDWATER. The Armed Services Committee convenes this morning to receive testimony on the President's Strategic Defense Initiative in review of the fiscal year 1985 defense authorization bill.

We began this hearing in executive session to receive a briefing on Soviet activities in the area of strategic defense.

We now resume the hearing in open session, and I would like to welcome our witnesses: Dr. Richard DeLauer, the Under Secretary of Defense for Research and Engineering, and Dr. Fred Ikle, the Under Secretary of Defense for Policy.

We are pleased you could join us this morning.

In his speech of March 23, 1983, President Reagan established as a national priority a research program designed to assess the technological feasibility of developing a comprehensive strategic defense capability for the United States.

The President spoke of moving away from our current sole reliance on offensive nuclear retaliation for deterrence. Instead he envisioned a strategic posture in which a combination of offensive and defensive capabilities would effectively deny the Soviets their objectives in war, and thus, present a lasting, credible deterrent.

In addition, an effective defense could assist our arms control efforts by serving as a disincentive to the unconstrained proliferation of offensive systems.

As a result of the President's guidance, the issue of strategic defense was studied extensively from both technological and policy perspectives. Our witnesses today will provide us with an overview of the administration's findings in these areas.

Once completed, this major study effort was integrated into a comprehensive program, and the resulting Strategic Defense Initiative was forwarded to the Congress in February of this year.

The Armed Services Committee will be carefully reviewing the request associated with the Strategic Defense Initiative. Support for an increase in funding this year will depend, in part, on judgments regarding: First, the role such a defensive capability could play in

enhancing the survivability—and thus the effectiveness—of our strategic deterrent; and second, whether ongoing Soviet activities in developing a comprehensive strategic defense capability pose a potentially serious threat to our deterrent capability.

The technological and policy perspectives presented to us today, as well as the intelligence information we received earlier, will assist us as we seek to weigh this program against other important strategic requirements.

Before we proceed with the testimony of our witnesses, I would like to turn to my distinguished colleague from Georgia, Senator Nunn.

Senator NUNN. I will insert my statement for the record.

PREPARED STATEMENT OF SENATOR NUNN

Mr. Chairman, I also welcome the Defense Department witnesses supporting the President's Strategic Defense Initiative. When he announced the initiative almost a year ago he stated the challenge thus: "What if free people could live secure in the knowledge that . . . we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies? Would it not be better to save lives than to avenge them?"

This objective freeing civilization from the bonds of the so-called "delicate balance of terror," is one that all our citizens can support; if we could be certain of achieving it, then the $26 billion the Administration is requesting for FY 85–89 as well as the additional tens or hundreds of billions to implement it would still be worth the cost.

However, there are indications in news reports, and in some of the prepared statements presented here today, that this is not the ultimate objective of the SDI program, that the technologists have already conceded that the objective of highly reliable population defense is unattainable. Mr. Chairman, I believe this Committee must clarify this issue now, before we begin a multibillion dollar technology exploration program. The American people have been led to believe that we are working to eliminate the need for offensive retaliatory capabilities by providing invulnerable defenses. If, instead, we are being asked to support a large and costly defensive program that is of only limited effectiveness in defending our citizens, then I think we fall back to a much larger debate about the role of ABM defenses as a complement to offensive nuclear systems. In other words, adding a defensive arms race to our present, substantial, costly strategic offensive modernization. Such a system, I suspect, lacks the general public enthusiasm of the President's initiative, and would not be able to justify a five-year program of the magnitude requested.

Mr. Chairman, we must remember that, even if we had developed and procured highly effective missile defenses, we would also have to invest heavily in bomber and air-breathing missile defenses, *and* invest heavily in improved conventional defenses in many areas such as Western Europe, Korea and the Persian Gulf, *and* make drastic and expensive changes to the fabric of our civilian society in order to protect against the covert or clandestine introduction of nuclear weapons into our cities.

These are just a few of the problems and issues that can be foreseen as the Congress considers the Space Defense Initiative. Given that this initiative, by DoD's own estimates, is going to call for the expenditure of $26 billion over the 5-year period before us, we will have to decide whether we can afford to devote *that much that fast* to ". . . provide the evidentiary basis for an informed decision on whether and how to proceed . . ."

Senator GOLDWATER. Dr. Ikle, you may proceed.

Dr. IKLE. It is my understanding we are now in open session.

Senator GOLDWATER. We will put your entire statement in the record. You may summarize it.

## STATEMENT OF DR. FRED C. IKLE, UNDER SECRETARY OF DEFENSE FOR POLICY

Dr. IKLE. Let me briefly summarize the statement.

There are several developments which have come together at this time that make the President's initiative timely.

The first is the continuing growth of ballistic missile threat from the Soviet Union, which could force upon us even more difficult improvements in our offensive forces.

Second, the advances in technology relative to ballistic missile defense that requires us to reassess the feasibility of various defensive systems, compared with our views 10 or 20 years ago.

Third, of course, is substantial, ongoing Soviet effort for ballistic missiles and air defense, in particular Soviet violation of the ABM agreement.

It is clear to all of us that a decision to deploy ballistic missiles defenses would have major implications for nuclear strategy, prevention of nuclear war, deterrence of aggression, preventing aggression, and for arms reduction.

Our policy on missile defenses must be shaped with this broad context in mind. It seems plausible that components of a multilayered defense could become deployed earlier than a complete system once a decision has been made to go ahead toward a multilayer system.

Such an intermediate version of a ballistic missile defense system, while not providing protection available from a multilayer system, may nevertheless offer useful capabilities in this transition phase. Also it could provide a hedge against acceleration in the Soviet strategic buildup.

One of the criticisms leveled against ballistic missile defense is the allegation that such defenses would overturn principles of deterrence that have worked throughout the nuclear age, but this criticism is based on amnesia, forgetting the history of the nuclear age that is behind us.

For the first 5 years of the nuclear era the United States had a monopoly and was invulnerable to nuclear attack.

During the next 10 years, at least, the United States maintained an extensive air defense network. Deterrence worked in that period as safely—indeed more safely than—in a subsequent period when we abandoned strategic defenses.

So, it cannot be said that that introduction of defenses into our strategic overall mix would overturn principles of deterrence that have worked for 35 years.

It is also worth noting that our European allies were more confident of the American guarantee during the period when we did have strategic defenses. In fact, the strategic benefits of air defenses in the bomber era in the 1950's are in some ways similar to the strategic benefits of missile defenses that we are looking toward in the future.

You know defenses against ballistic missiles would reduce the confidence of Soviet planners in designing an attack, and Soviet planners could not predict a successful outcome. His weapons might be unable to reach high-priority targets. This would enhance deterrence.

Beyond that we hope that a more effective multitier system would also contribute to reduce the threat of attack.

Now, there are many important uncertainties that cannot be resolved until more is known about the technical characteristics of defensive systems, the future arms policies of the Soviet Union, the prospect for arms reduction, and the Soviet response to our initiatives.

Our assessment of these issues should and must affect the future design and deployment decisions. Despite these uncertainties at this time, a vigorous R&D program is essential to assess and provide options for future ballistic missile defenses.

At a minimum, it is essential to ensure that the United States will not be faced in the future with a one-sided situation where the Soviet Union has both offensive and defensive systems.

There is no basis for assuming that decisions on employment of defensive systems rest exclusively with the United States.

On the contrary, Soviet history indicates the Soviets are more likely and are better prepared than we to deploy ballistic missile defenses whenever they feel it is to their advantage.

The U.S. research and development on ballistic missile defense should provide a variety of deployment options that will help resolve these uncertainties and over time offers us flexibility to respond to new opportunities.

By contrast, if we do not go ahead with the research program, we will condemn future Presidents and future Congresses to remain locked into the present exclusive emphasis on deterrence through offensive systems alone.

Your successors might regret it if you left them without alternatives both to cope with new dangers and alternatives to respond to newer opportunities.

Over time our research and development on ballistic missiles might induce a shift in Soviet emphasis from ballistic missiles in favor of air-breathing forces. That in itself would be an advantage because the air-breathing forces are less of a first strike threat.

In addition, by constraining Soviet efforts in their further buildup of offensive forces and making the Soviet efforts more costly because they have to plan for a variety of defenses that they may or may not confront, we can increase our leverage in inducing the Soviets to agree to mutual reductions in offensive nuclear forces.

In turn, such reductions could enforce the potential of defensive systems. Reductions of the magnitude proposed by us in START would be very effective in this regard.

We are proposing now for the forseeable future a U.S. ballistic missile defense research and development program which would be consistent with existing U.S. treaty obligations.

If the decision is later made on deployment, then the ABM treaty would have to be revised.

If the results of the research and development program warranted such a decision in the future, it would be appropriate to address such a decision in the context of a joint consideration of offensive and defensive systems.

Remember, this was the context actually contemplated at the outset of the SALT negotiations in the late sixties. But while we reached agreement in limiting defenses, our anticipations of associated limitations on offensive forces have not been realized.

Because of the present uncertainties, no detailed blueprint for arms control in such a transition from offensive to defensive forces can be drawn at this time.

A list of arms control measures might include agreed schedules for introducing defensive systems on both sides, and associated schedules for reduction in ballistic missiles and other nuclear forces.

Confidence-building measures and controls on devices designed specifically to attack or degrade the other side's defensive systems are other potential arms control provisions. At this time these things are, of course, speculative.

Now, if the United States and the Soviet Union in a future period decided to realize the protection offered by a fully effective strategic defense, we would also require air defenses to defend against all offensive arms.

The integration of defenses against air-breathing vehicles with defenses against ballistic missiles requires further study.

In summary, the essential purpose of the U.S. Strategic Defense Initiative first of all, is to provide the technical knowledge necessary to support deployment decisions in the future by successor administrations. If such deployment were made, it would be for the purpose of diminishing the risk of nuclear destruction through defense measures, rather than a continued, sole reliance on the threat of nuclear retaliation.

The purpose of defense is to provide a safer, less menacing way of preventing nuclear war in the decades to come.

I think this is worth noting that some of the very fervently articulated opposition to ballistic missile defense is in part a matter of a fixed belief which has, in some cases, not been updated to be in line with reality.

There are internal contradictions. Realize, for example, we are all agreed we do not want offensive biological weapons, that biological weapons defense is what we want, to the extent needed.

Recall that so far Congress has not agreed to the offensive chemical binary weapons, but has agreed to extensive defenses in chemical weapons, which is good, which is what we want.

But in the nuclear area, some say this theory is reversed. You ought to prohibit defensive weapons and focus on offensive weapons. Yet, nucletar weapons are just as crucial, if not more so, than, say, chemical weapons.

I mention it only to loosen up this discussion, so that we can all look at the reality and not attack this in a purely ideological fashion without reference to what the Soviets are doing, to what new technology is providing, and what the strategic relationship consists of.

It seems to me the response of the American people to the President's initiative indicates that there is interest in this pragmatic approach, in this vision of a future that will provide new hope.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Ikle follows:]

PREPARED STATEMENT OF HON. FRED C. IKLE, UNDER SECRETARY OF DEFENSE FOR POLICY

Mr. Chairman, Thank you for inviting us to discuss the President's Strategic Defense Initiative with you.

Almost a year ago, President Reagan offered a hopeful vision of the future, based on a program to "counter the awesome Soviet missile threat with measures

that are defensive." Many Americans welcomed this initiative, sensing that it could provide a road to escape from the confrontation of ever-more destructive missiles forces. But there were others who had doubts about the initiative, and some who are still strongly opposed to it.

Several developments have come together at this time, that made the President's initiative timely:

First, the continuing growth of the ballistic missile threat from the Soviet Union, that could force upon us ever more difficult improvements in our offensive forces for second-strike deterrence.

Second, advances in technologies relevant for ballistic missile defense that require us to reassess the feasibility of various defensive systems.

Third, the substantial, ongoing Soviet efforts for ballistic missile and air defense, in particular the Soviet research and development programs for ballistic missile defenses and the fact that the Soviet Union has now deployed a large radar in Central Siberia which almost certainly violates the ABM Treaty.

Clearly, the role of ballistic missile defenses must be viewed in the context of the overall military and political requirements of the United States. A decision to deploy ballistic missile defenses would have major implications for nuclear strategy, the prevention of nuclear war, deterrence of aggression, and arms reduction. Our policy on missile defenses must be shaped with this broad context in mind. To permit informed and prudent decisions we have to conduct research on many aspects of the relevant technology and develop a range of specific choices.

It seems plausible that components of a multi-layered defense could become deployed earlier than a complete system. Such intermediate versions of a ballistic missile defense system, while unable to provide the protection available from a completed multi-tiered system, may nevertheless offer useful capabilities. A research and development program that provides options to deploy such intermediate capabilities would be an important hedge against an acceleration in the Soviet strategic buildup. And if such intermediate systems were actually deployed, they could play a useful role in defeating limited nuclear attacks and in enhancing deterrence against large attacks.

One of the criticisms that has been levelled against ballistic missile defense is the allegation that such defenses would overturn principles of deterrence that have worked throughout the nuclear age. This criticism, Mr. Chairman, is based on amnesia—forgetting the true history of the nuclear age.

For the first five years of the nuclear era, the United States, having a monopoly, was invulnerable to nuclear attack. For the next ten years, the United States maintained an extensive air defense network to protect North America from attack by the Soviet bomber forces—the only Soviet forces then that could have reached the United States. Deterrence worked in that period, as safely—indeed, far more safely—than in the subsequent period when we abandoned strategic defenses.

It is also worth noting that our European allies were more confident of the American guarantee during the period when we did have strategic defenses and were less vulnerable to Soviet attack, than during the present period when we do not have defenses and are much more vulnerable.

The strategic benefits of air defenses in the bomber era of the 1950's are similar to the strategic benefits of missile defenses, including those that could be deployed before a more effective multi-tiered system would be operational.

What are these benefits? US defenses against ballistic missiles would reduce the confidence of Soviet planners in designing an attack. The Soviet planners could not predict a successful outcome. His weapons might be unable to reach high-priority targets. Defenses could protect US command and control centers, which would increase the safety of the US deterrent posture.

We recognize full well that there are many important uncertainties that will not be resolved until more is known about the technical characteristics of defensive systems, the future arms policies of the Soviet Union, the prospects for arms reduction agreements, and the Soviet response to US initiatives. Important questions to be addressed are: (1) the absolute and relative effectiveness of future US and Soviet defensive systems and how this effectiveness is perceived by each side; (2) the vulnerabilities of the defensive systems (both real and perceived); (3) the size, composition, and vulnerabilities of each side's offensive forces; and (4) the overall US-Soviet military balance. While these uncertainties cannot be fully resolved, we will learn more about them with the passage of time. Our assessment of these issues should, of course, affect our design and deployment decisions.

Despite these uncertainties, a vigorous R&D program is essential to assess and provide options for future ballistic missile defenses. At a minimum, such a program is necessary to ensure that the United States will not be faced in the future with a one-sided Soviet deployment of highly effective ballistic missile defenses to which the only US answer would be a further expansion of our offensive forces, such as the addition of penetration aids and more launchers. Such a situation would be fraught with extremely grave consequences for our security and that of our allies.

There is no basis for assuming that decisions on the deployment of defensive systems rest solely with the United States. On the contrary, Soviet history, doctrine, and programs (including an active program to modernize the existing Moscow defense, the only operational ballistic missile defense in existence) all indicate that the Soviets are more likely and better prepared than we to deploy ballistic missile defenses whenever they deem it to their advantage.

Since long-term Soviet behavior cannot reliably be predicted, we must be prepared to respond flexibly. A US research and development program on ballistic missile defense that provides a variety of deployment options will help resolve the many uncertainties we now confront, and over time offers us flexibility to respond to new opportunities. By contrast, without the research and development program, we condemn future US Presidents—and future Congresses—to remain locked into the present exclusive emphasis on deterrence through offensive systems alone. Mr. Chairman and members of this Committee, your successors might deeply regret if you left them without any alternatives to cope with new dangers, without alternatives to respond to new opportunities.

Over time, our research and development on ballistic missile defense might induce a shift in Soviet emphasis from ballistic missiles, with the problems they pose for stability, in favor of air-breathing forces with slower flight times. By constraining Soviet efforts to maintain offensive forces (and making them more costly), US options to deploy ballistic missile defenses might increase our leverage in inducing the Soviets to agree to mutual reductions in offensive nuclear forces. In turn, such reductions could reinforce the potential of defensive systems to stabilize deterrence. Reductions of the magnitude proposed by the United States in the Strategic Arms Reduction Talks (START) would be effective in this regard.

In its initial stages, a US ballistic missile defense research and development program would be consistent with existing US treaty obligations. Were we later to decide on deployment of a widespread defense of the United States, the ABM Treaty would have to be revised. If the results of the research and development program warranted such a decision in the future, it would be appropriate to address it in the context of a joint consideration of offensive and defensive systems. This was the context contemplated at the outset of the SALT negotiations; but while we reached an agreement in limiting defenses, our anticipations of associated limitations on offensive forces have not been realized.

Both the Soviet national interest and traditional themes in Soviet strategic thought give reason to expect that the Soviets will respond with an increased shift toward defensive forces relative to offensive forces. The nature of a cooperative US-Soviet transition to defensive forces would depend on many factors, including the technical aspects of each side's defensive systems, their degree of similarity or dissimilarity, and whether US and Soviet systems would be ready for deployment in the same period. Because of the present uncertainties, no detailed blueprint for arms control in such a transition period can be drawn at this time. A list of arms control measures might include agreed schedules for introducing the defensive systems of both sides, and associated schedules for reduction in ballistic missiles and other nuclear forces. Confidence-building measures and controls on devices designed specifically to attack or degrade the other side's defensive systems are other potential arms control provisions.

If both the United States and the Soviet Union deployed defensive systems against a range of nuclear threats, it would not diminish the need to strengthen US and allied conventional military capabilities. Moreover, if the United States in such a future period decided to realize the protection offered by a fully effective strategic defense, we would also require air defenses. The integration of defenses against air-breathing vehicles with defenses against ballistic missiles requires further study.

Defense against ballistic missiles offers new possibilities for enhanced deterrence of deliberate attack, greater safety against accidental use of nuclear weapons or unintended nuclear escalation, and new opportunities and scope for arms control. The extent to which these possibilities can be realized will depend on how

our present uncertainties about technical feasibility, costs, and Soviet response are resolved.

The essential purpose of the US strategic defense initiative is to diminish the risk of nuclear destruction. In contrast with continued, sole reliance on the threat of nuclear retaliation, the purpose is to provide for a safer, less menacing way of preventing nuclear war in the decades to come.

Mr. Chairman, the members of this Committee will have noted that some of the most fervent opposition to ballistic missiles defenses is ideological. That is to say, it is not based on facts, but on fixed beliefs. Any proposed revision of this belief is attacked as heresy, any internal inconsistencies of the belief are ignored. Thus, you may have one and the same person:

One, applaud the Biological Weapons Convention because it prohibits offensive use of biological weapons, while defenses are permitted;

Two, oppose binary chemical weapons for deterrence, but support defensive chemical warfare equipment; and

Three, turn these rules upside down for nuclear arms, by supporting offensive arms but opposing defensive ones. The ideological opponents to nuclear defense also seem to forget that the basic premise of banning missile defenses has been disproven. The premise was, that the prohibition of such defenses would permit us to curb the growth in offensive arms. But after the ABM treaty the Soviet offensive build-up continued as if there had been no change.

A curious aspect of the ideology against missile defenses is the notion that outer space must be reserved for offensive missiles, so that they can travel without obstruction to create holocaust on earth. The ideology demands a sanctuary in outer space that excludes any protection for the cities we live in, but offers a free ride for the missiles that could destroy our cities.

The American people, in reacting to the President's initiative, and in various opinion polls, have already shown that they do not agree with these ideologues. They are more pragmatic. They support an initiative that offers hope for the future. They do not wish to preserve for the next generation the present nightmare of huge and unimpeded missile forces, constantly poised for mass destruction.

Senator GOLDWATER. Thank you very much.

Dr. DeLauer, do you have a statement?

## STATEMENT OF DR. RICHARD D. DeLAUER, UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Dr. DELAUER. I have a statement that I would like to have included in the record, Mr. Chairman.

I will try to summarize my remarks so that we can get on with some of your questions.

We have in the audience, Mr. Chairman, Dr. Edward Gerry and Dr. Gerold Yonas, who participated in the work that the Fletcher committee did. They are prepared to make a statement if they can add to the understanding of the problem.

Senator GOLDWATER. That will be done.

Dr. DELAUER. The President's speech of just about a year ago resulted in the Defense Department being directed to conduct an intensive analysis to define a research and technology program.

The result of that intensive study which is embodied in the Fletcher report concluded that advanced defensive technologies could offer a potential to increase deterrence by enhancing survivability.

I want to make clear at the outset that the strategic defense initiative is not a weapons development program. That is, no such decision has been made by this administration, as Dr. Ikle has pointed out.

The purpose of the SDI program is to provide the analysis, calculation, and experimental evidence necessary for an informed decision on whether to proceed to a system-development program. We don't expect this point to be reached until the early to midnineties.

As mentioned before, what we are requesting in the 1985 budget submission to the Congress is authorization and funds necessary to carry out this research and experimental technology program in the amount of $1.77 billion for the Department of Defense, and for the Department of Energy, $210 million.

Now for comparison with 1984, for the same categories of effort, it is an increase by a factor of about 71 percent. We are spending out of the 1984 appropriation about $991 million in the five areas of activity, which for 1985, we are proposing to you now, totals $1.77 billion.

As I mentioned before, in 1986 the tentative plans are to ask Congress for about $3.8 billion for the Department of Defense and $290 million for the Department of Energy.

We have no idea at the present time of the cost of a deployed system. That is what we are trying to find out. Our program includes a continuing analysis of defensive-offensive concepts and operation, the very things that Senator Cohen was concerned about.

This is not a new start. Detailed examination of the elements that we are requesting of the Congress will find that in some form or another, we have been working on most of these technologies, not only in the year 1984, but in the year 1983 and in the year 1982.

The program will be managed centrally. The program manager will report to the Secretary of Defense. He is in the process of selecting that individual at the present time.

The concept of the central management will be that that program manager, in consultation with the Secretary of Defense, will decide what he should submit, as a budgetary program to the Congress, in five areas: (1) Surveillance, acquisition, and tracking; (2) directed energy weapons; (3) kinetic energy weapons; (4) systems analysis and battle management; and (5) what we have called support systems which are things we talked about earlier, power supplies, how you do this and that to support this.

These will essentially be program elements that will be kept at the Secretary of Defense level for management control.

They will in turn be broken out further into detailed programs and projects that will be done in the services and by DARPA. The descriptions of them, Mr. Chairman, are contained in your congressional data sheets, in the descriptive summaries.

The concept of this defense is as follows: We are looking at the boost phase, which is the time from lift-off to the burnout of the booster. We are also looking at the system that would handle the postboost phase, which is from deployment of the postboost vehicle, but prior to the deployment of the reentry vehicle during the midcourse phase where the reentry vehicles will be deployed from the bus. Finally, we are looking at the terminal phase as it comes into the target.

The highest leverage, as we discussed earlier, is in the boost phase, but it is also the most difficult.

I think at this time, Mr. Chairman, if you would like to hear from Dr. Gerry and Dr. Yonas, they are available.

Senator GOLDWATER. If any of the members have questions that they would like to direct to any of your staff, they may do so.

Dr. DELAUER. Why don't I just conclude my statement?

Senator GOLDWATER. We do have a problem with time.

Dr. DeLauer. Let me conclude by emphasizing again that SDI is a technical-feasibility program, not a decision to deploy. SDI is largely a new direction for many longstanding technology programs presently being carried out. It is the focus of the application of these technologies on the strategic defense issue.

We hope as we conduct this program in the next few years that indeed options will be presented to future administrations and Congresses to provide a greater capability for enhancing the strategic deterrence that is essential to this country's security.

[The prepared statement of Dr. Richard D. DeLauer follows:]

PREPARED STATEMENT BY HON. RICHARD D. DELAUER, UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

INTRODUCTION

In a speech to the American people a year ago, President Reagan offered the hope of a world made safe from the threat of ballistic missiles. This hope is based on recent advances of technology which may offer us, for the first time in history, the opportunity to strengthen deterrence through effective defenses, rather than only through the threat of retaliation. President Reagan is determined that we explore fully this opportunity.

To guide the efforts of those working toward this important goal, the President directed an intensive analysis to define a research program to investigate the technical feasibility of an effective defense against ballistic missiles, and to assess the implications of such a program for the prevention of nuclear war, for the deterrence of aggression, and for the prospects for arms control. This study was conducted last summer, and concluded that advanced defensive technologies could offer the potential to enhance deterrence and help prevent nuclear war by reducing significantly the military utility of Soviet preemptive attacks and by undermining an aggressor's confidence of a successful attack against the United States or our allies. The study also identified a research program that will clarify future technical options for a defensive system.

Although the study acknowedged that there are uncertainties that will not be resolved until more is known about the technical characteristics of defensive systems and the possible responses of the Soviet Union to U.S. initiatives, it concluded that a research program should be started now. We must start now because the Soviet Union has pursued advanced ballistic missile defense technology for a number of years, and has the only active ballistic missile defense system in the world. Unilateral Soviet deployment of an advanced system capable of countering Western ballistic missiles—added to their already impressive air and passive defense capabilities—would weaken deterrence and threaten the security of the United States and our allies. Thus, our research efforts will provide a necessary and vital hedge against the possibility of a one sided deployment. In addition, our effort could provide a potentially powerful tool to moderate the development of future offensive systems and to make the world more stable and secure.

It must be understood that our program is not a system development program. No decision has been made to develop and deploy any weapons or other elements of the potential system. Our state of knowledge of the relevant technologies is inadequate. Consequently, the aim of this program is to improve our knowledge of the revelant technologies by providing firm calculations and experimental evidence on what such technologies could do, and at what cost. Put in other words, our program is a research effort to provide the evidentiary basis for an informed decision on whether and how to proceed into system development. For a full-multi-tiered system, we expect to complete the provision of this evidentiary basis by the early 1990's. A careful analysis of defensive strategy and concepts of operation is an essential element of the basis for an informed decision. Our program also includes such an analysis.

FUNDING

We plan an aggressive, adequately funded program to pursue the relevant technologies at the maximum reasonable rate. For fiscal year 1985 we are requesting approximately $2 billion (total for Dod and DoE). We anticipate that during the fiscal year 1986–89 period, approximately $24 billion will be required.

It is impossible to estimate now, with any precision, the full costs of developing and deploying a comprehensive strategic defense system. If a system were deployed, the ultimate costs would depend on the technological approaches selected for deployment and the size of the defensive system required. These factors, in turn, would depend in part on Soviet reactions and on the nature of future arms control agreements. It is true that the total costs would be significant in relation to our overall strategic forces program. These costs, however, would be spread over 20 years or more and could well be offset, or at least partially offset, by reduced spending on strategic offensive systems. Most importantly, costs must be judged relative to expected benefits of a system that could make nuclear war less likely.

The program is not a "new start" in the usual sense. Substantially all of the relevant technologies have been funded in previous years, but not all have been specifically related to defending against ballistic missiles. To implement the President's Strategic Defense Initiative, we have focused these previously existing related research efforts into a single program, and augmented the previously planned level of DoD funding for fiscal year 1985, $1,527 million, by $250 million, for a total request of $1,777 million. The DoD request is for 71% real growth in relevant technologies from fiscal year 84 to 85, and 16% relative to pre-SDI plans for fiscal year 1985. Part of the Initiative includes technologies involving nuclear devices, which are developed by the Department of Energy. Their work in direct support of this initiative in fiscal year 1985 is a portion of their nuclear research, development, and test funding. It is estimated at $210 million (It is not a separate, specific line item.) for a total program of $2 billion.

### MANAGEMENT

To manage the DoD's portion of this effort, we are establishing a Strategic Defense Technology Office, which will be headed by the SDI Program Manager who will report directly to the Secretary of Defense. Mr. Weinberger is presently in the process of selecting him.

The DoD portion of the program has been divided into five technical areas, and a new program element has been established for each of them. These program elements are:

1. Surveillance, acquisition, and tracking,
2. Directed energy weapons,
3. Kinetic energy weapons,
4. Systems analyses and battle management, and
5. Support programs.

These are Defense level program elements. The funds will be held in the Office of the Secretary of Defense and will be provided, at the determination of the SDI program manager, to the individual Services and Defense Agencies who will execute the individual efforts.

### THE CONCEPT OF DEFENSE

The flight of a ballistic missile can be considered in four phases. The first is the boost phase, in which the first and second stage rocket engines of the missile are burning. They produce an intense and unique infrared signature. In the second, or post-boost phase, the bus separates from the main engines, and the multiple warheads are deployed from the bus, along with any penetration aids such as decoys and chaff. In the third, or mid-course phase, the multiple warheads and penetration aids travel on ballistic trajectories through space, above the earth's atmosphere. In the fourth, terminal phase, the warheads and penetration aids reenter the earth's atmosphere, where they are affected by atmospheric conditions.

Our program seeks to explore technologies enabling the engagement of attacking missiles in all four phases of their flight. This would require a number of capabilities, including global, full-time surveillance to warn of an attack. There is leverage in engaging the missiles in the boost phase, because the multiple warheads and penetration aids have not yet been deployed. After deployment, we must be able to discriminate warheads from decoys, so we can target only the real threats. We must be prepared for the attacking warheads to be salvage fuzed; therefore, our terminal defenses must engage them at as high an altitude as possible. And in addition to the individual engagement capabilities, we must have a survivable battle management system capable of efficient, global control.

The technologies for the terminal defenses are also likely to be applicable to defense against the shorter range nuclear ballistic missiles, such as submarine launched ballistic missiles and theater range ballistic missiles, which may not have trajectories high enough to permit their attack with exoatmospheric systems, and which have short times-of-flight. Such technologies are important for defense of our allies.

THE TECHNOLOGIES

*Surveillance, acquisition, and tracking*

Surveillance, acquisition, tracking and kill assessment (SATKA) includes sensing of information for initiation of the defense engagement and for battle management and assessment of the status of forces before and during a defense engagement against nuclear ballistic missiles. It also includes signal processing and data processing for discrimination of threatening reentry vehicles from other objects and backgrounds. A crucial philosophy of design is that surveillance and acquisition should be autonomous in each phase of the engagement, but that tracking and kill assessment should be consultative through battle management. These requirements are necessary so that the contributions to leakage from missed detections remain independent to insure very high quality tracking and kill assessment.

The goal of this program is to develop and demonstrate the capabilities needed to detect, track, and discriminate objects in all phases of the ballistic missile trajectory. The technology developed under this program is quite complex, and any eventual system must operate reliably even in the presence of disturbances caused by nuclear weapons effects or direct enemy attack.

The program has several component technology development programs that culminate in hardware demonstrations. A focused effort to study the observables during each phase is the first major element of the program. Optically, infrared, and radar signatures of reentry vehicles and penetration aids will be measured. The new techniques of radar imaging represent another element. Similarly, optical imaging, using lasers rather than radar beams, will be pursued. Finally, a substantial effort is included to develop cooled infrared sensors and near real-time signal processing.

The technology programs outlined above will lead to a series of hardware demonstrations. Four key demonstrations have been identified at this time, with the possibility of more in the 1990s as technology progresses. One demonstration will be an advanced boost-phase detection and tracking system. Another major demonstration is designed to track and discriminate attacking objects in midcourse using advanced Long Wavelength Infrared (LWIR) sensors. The ability of airborne infrared sensors to identify and track reentering objects will be demonstrated in the Army's Airborne Optical System (AOS) development program. Ground radar imaging and tracking demonstrations will continue as part of the Army's terminal and midcourse defense programs. As other technologies mature, such as radar and optical imaging, new demonstrations will be conducted. As these demonstrations are completed, we will have obtained the technical information required to decide whether defensive systems of the necessary capability can be built, considering this key element of the defense design.

*Directed energy weapons*

This program pursues four basic concepts identified as potentially capable of meeting a responsive threat—space-based lasers, ground-based lasers, space-based particle beams, and nuclear driven directed energy weapons. It also provides for establishment of the National Tri-Service Laser Test Range at White Sands Missile Range, NM. The basic technical thrusts include beam generators (lasers and particle accelerators), beam control, large optics, and acquisition, tracking and pointing. Our request includes funds to search for technological opportunities for new and innovative capabilities.

The goal of the directed energy technology program is to bring the most promising concepts for boost and post-boost phase intercept to an equivalent technical maturity in the early 1990's. At that point we expect to be able to demonstrate a readiness for technology validation in system level demonstrations of the concepts selected to move into that phase. To achieve that goal we plan to demonstrate the feasibility of the leading candidate beam generators by the mid 1980's and their scalability to weapon performance levels in the late 1980's or early 1990's. In beam control we will demonstrate by the end of the decade a capability to control wavefront errors, maintain beam alignment within the system, compensate for atmospheric effects; and to provide the components necessary to

transmit and control the high intensity beams. In large optics, we plan by the 1990's to demonstrate several approaches for providing the large diameter ground and space-based optics required for most directed energy concepts and all surveillance systems employing optical and electro-optical sensors. In our acquisition, tracking and pointing efforts we envision in-space tests that verify our capability to point with the necessary precision, to acquire and track targets of interest, and to provide early experiments in imaging and designation. Finally, we are considering integrated technology experiments to show that we can integrate the weapon subsystems with requisite efficiency. With these demonstrations completed we will have provided the basis for a decision whether we are ready to move into the more complex system level demonstrations required in the technology validation phase of R&D.

*Kinetic energy weapons*

Kinetic energy weapons include interceptor missiles and hyper-velocity gun systems. The primary roles for these weapons include (1) midcourse engagement of reentry vehicles not destroyed during boost or post-boost phases, and of post-boost vehicles that have not dispensed all of their RV's, (2) terminal (i.e. endoatmospheric) engagement of RV's not destroyed during the previous phases of their flight, (3) space platform defense against threats not vulnerable to directed energy weapons, and (4) boost-phase engagement of short time-of-flight, short range submarine launched ballistic missiles. Additional roles for these weapons include (1) boost phase intercept from space-based platforms and (2) midcourse engagement from space-based platforms. The kinetic energy weapons will rely on nonnuclear kill mechanisms to destroy the intended target. The key technologies required to develop these weapons include (1) fire control, (2) guidance and control, (3) warheads and fuzing for guided projectiles capable of being launched by missiles or hypervelocity guns, (4) hypervelocity launchers, (5) and high performance interceptor missiles.

The goals of the kinetic energy weapons program are: (1) expansion of the technology data base to support the development of improved and advanced weapons and (2) development and flight demonstration of kinetic energy weapons that are designed to satisfy the SDI mission needs outlined above. Technology programs are planned for endoatmospheric and exoatmospheric interceptor designs, a hypervelocity launcher design, and the systems engineering and analysis required to integrate the various advanced subsystems and components into effective system constructs. Investigations will also be undertaken in novel and advanced techniques which have the potential for a high payoff in performance and/or cost effectiveness in the design of these weapons systems. Hardware development and flight test demonstration of a number of kinetic energy weapons system designs will also be undertaken as part of this program.

*Systems analyses and battle management*

This program has been divided into two technology projects. The Battle Management/Command, Control, and Communications technology project will develop the technologies necessary to allow eventual implementation of a highly responsive, ultra reliable, survivable, endurable and cost effective BM/$C^3$ system for a low-leakage defense system. This BM/$C^3$ system is expected to be quite complex and must operate reliably even in the presence of disturbances caused by nuclear effects or direct enemy attacks. This program seeks to (1) develop the tools, methods, and components necessary for development of the BM/$C^3$ system, and (2) quantify the risk and cost of achieving such a BM/$C^3$ system to control the complex, multi-tiered SDI system. The systems analyses project will provide overall SDI systems guidance to weapons, sensors, $C^3$, and supporting technologies. Tasks include threat analyses, mission analyes, concept formulation, system conceptual design, and subsystem requirements definition, system evaluation, and technology assessment for all levels of a multi-tiered, low-leakage system.

One of our early tasks will be to conduct a "sanity check" on the defense responsibilities allocated to the various phases of the multi-tiered system by the Defensive Technology Study. Even though we know that many of our weapons and sensor concepts will require orders of magnitude performance improvements to accomplish the President's defense objectives, we also know that effective overall system guidance will efficiently focus these technology efforts and help us avoid "gold plating" and "blind alleys."

Obviously, if such a complex defense system were deployed, it would require positive control of its operations. We have to assure that we can turn the system on when it is needed and assure that it is safe when not needed. Just as

importantly, the system must not be regarded as a "paper tiger" by the Soviets if it is to serve as an effective deterrent to nuclear war. Therefore, its credibility must be based on a demonstrated capability to manage the surveillance, tracking and intercept actions over the multi-tiers of this complex system. The information processing capability, specifically the development of complex software packages, necessary to associate outputs from multiple sensors, performing discrimination and designation, and "birth to death" tracking, plus kill assessment is expected to stress software development technology.

Our immediate need is for effective approaches and tools for achieving high performance processors and software, and responsive communications networks that provide high reliability and fault tolerance. Evaluation and demonstration of this complex defense system and its $C^3$ will largely depend upon simulation. Therefore, development of effective modeling and simulation tools will also be an early priority endeavor.

*Support programs*

This program element funds a collection of essential efforts designed to provide timely answers to a variety of critical SDI support related questions. The Defensive Technologies Study identified two areas that should receive priority attention in the SDI program.

First, for each weapon concept under consideration, we must develop the ability to predict scientifically the minimum energy that will be required, in a variety of engagement scenarios, to kill unhardened, retrofit hardened, and responsively hardened Soviet systems. These data will have a large effect on our choice of candidate system concepts. The feasibility of SDI may well hinge on the results of these efforts. The Lethality and Target Hardening project of the Support Programs effort is structured to provide these data.

Second, the ability of any deployed ballistic missile defense system to survive in the face of dedicated attack and to continue to function effectively must be established. The concepts, technologies and tactics necessary to insure continued system effectiveness will be defined and developed under the Survivability element of Support Programs. The output from this effort will be fed into all other elements of the SDI—particularly into the Systems Concepts and Analyses efforts.

Additionally, support programs will fund development of the technologies necessary for improved space logistics capabilities. These include the advanced orbital transfer vehicle capabilities that SDI will likely require. We will also evaluate the technical feasibility and cost effectiveness of using extraterrestrial materials for certain SDI applications.

Many SDI system elements (weapons, sensors, etc.) will require large amounts of electrical power. The Power and Power Conversion element of support programs will fund concept definition and technology development for multimegawatt power systems. This effort will fully exploit the technologies being developed in the joint NASA, DoE, DARPA SP–100 program. Both nuclear and nonnuclear systems and technologies will be considered.

*The Department of Energy's contribution to the SDI program*

Although funded separately, the Department of Energy (DoE) program is integral to the overall Strategic Defense Initiative program. DoE funded efforts include concepts for nuclear driven x-ray lasers, survivability and lethality, and support subsystems. Other efforts, such as space-based neutral particle beam technology, are being performed by the DoE laboratories with DoD funds. A memorandum of understanding, to be signed by the Secretaries of Defense and Energy, will establish specific relationships between the elements of DoD and DoE engaged in planning and execution of the SDI. In accord with current policy, the DoE will have primary responsibility for nuclear source development, and the DoD for applications, target acquisition, beam control, and pointing/tracking. The DoE laboratories have unique facilities and capabilities to address many aspects of these difficult problems.

## CONCLUSION

In summary, we believe that an effective defense against ballistic missiles could have far-reaching implications for enhanced deterrence, greater stability and improved opportunities for arms control. Hence we have gathered the existing efforts in the relevant technologies into a focused program of five DoD program elements, and added emphasis to some of the efforts, thereby augmenting the planned funding by about sixteen percent. Our efforts do not seek to replace

proven policies for maintaining the peace, but rather to strengthen their effectiveness in the face of a growing Soviet threat. The essential objective of the Strategic Defense Initiative is to provide future options to diminish the risk of nuclear destruction and to increase overall stability.

By the end of the decade, we will have conducted a number of ground, airborne, and space experiments. The knowledge gained from these tests will help to identify those technologies that are most promising and support decisions in the early 1990's on whether and how to proceed with development of ballistic missile defenses.

Senator GOLDWATER. Thank you, Dr. DeLauer.

Dr. DELAUER. Mr. Chairman, I would like to also submit for the record prepared statements from Dr. Fletcher, who is the chairman; Dr. Agnew, who is the vice chairman; Dr. Yonas, and Dr. Gerry, members of the defensive technologies study team. Those statements will be submitted for the record.

Senator GOLDWATER. They will be printed in the record.

[The prepared statements of Dr. Fletcher, Dr. Agnew, Dr. Yonas, and Dr. Gerry follow:]

PREPARED STATEMENT BY DR. JAMES C. FLETCHER, THE UNIVERSITY OF PITTSBURGH, CHAIRMAN, DEFENSIVE TECHNOLOGIES STUDY TEAM

I am pleased to provide a written statement for your deliberations on the Strategic Defense Initiative (SDI). By way of background I chaired the Defensive Technologies Study, which has been used by the Department of Defense and the Department of Energy as the technical guidance for the SDI. I would like to preface my remarks with my firm conviction that our conclusions, as set forth in the Defensive Technologies Study reports, represent the most comprehensive and technically valid analysis possible. To a person, I am convinced that we had available those most familiar with the technical issues and most able to produce an accurate and unbiased assessment. I have never worked with a more impressive or dedicated group of people than were assembled for the Defensive Technologies Study. The conclusions of the study fully warrant your consideration as the best technical assessment possible.

I will not review the technical details of our study. Other testimony you have heard today and will review in the coming months will cover those areas. I would however, like to preface my remarks with a discussion of the ground rules we used for our work. First, we concentrated on what I call the "long-poles in the tent." By this I mean that we recommended intensive efforts only on those technical issues upon which the ultimate feasibility of an effective ballistic missile defense hinges. As a corollary to this, we recommended deferring development of well understood technologies until they are needed. For example, if we choose to deploy boost-phase systems we will most likely need upgraded space launch systems. However, my colleagues at NASA assure me that new launch vehicles could be developed in less than ten years. For this reason we did not recommend an immediate effort on this area. Correspondingly, we were not asked for, nor did we recommend resources for assuring readiness for responding to a Soviet ABM "breakout." Such needs, if justified, would require separate funding. We did, however, recommend that ongoing development in some areas, even though it may not be needed until later, not be subject to precipitous adjustment. For example, terminating ongoing programs which are nearly complete, but which must be restarted in a few years at great costs, was not considered prudent. Finally, we firmly believe that it is essential to preserve substantial resources, at least 5%, for new and innovative technologies. Just as the technologies which appear to make effective ballistic missle defense conceivable have only emerged in the last few years, we believe that the technologies which may eventually be incorporated in such a defense have probably not yet been developed. I feel that the latter ground rule is of paramount importance, particularly with regard to involving our academic communities. I urge you to work hard to preserve this vital resource which has so often in the past been sacrificed in the interest of near-term requirements.

I want to emphasize that we did not recommend a system development and deployment program. Rather we recommended a research and technology program which will provide essential data on which future Presidents and Congresses will be able to make decisions.

I would like to relay our general conclusions to you word for word. These conclusions were worked out by the study team panel leaders with great care. These are conclusions which I am confident represent the concensus of the team:

Powerful new technologies are becoming available that justify a major technology development effort that provides future technical options to implement a defensive strategy.

Survivability is an especially critical issue whose resolution requires a combination of technologies and tactics that remain to be worked out.

The deployment of directed-energy weapons in space by either or both sides: not only requires significant technical advances but also poses difficult policy issues which need to be addressed.

Technologies currently within the state-of-the-art will not provide solutions to unconstrained, long-term threats.

Focused development of technology for a comprehensive ballistic missile defense will demand strong central management, dedication, and perseverance.

The most capable systems have multiple layers. Of these layers, boost-phase intercept has the greatest leverage but is also most difficult to achieve.

Significant demonstrations of critical ballistic missile defense functions can be performed in the next ten years which will also provide visible evidence of progress toward in-depth ballistic missile defense.

I would like to elaborate on these points and respond to a number of misconceptions which may have been promulgated by both advocates and opponents.

First, the entire study team strongly endorsed the requirement for strong central management. The technologies which we are pursuing are so broadly based and so require long-term commitment, that they must be centrally managed. By this I mean that the program must be structured so that its manager can shift resources from less promising to more promising areas. The program manager further must be able to budget and plan for multi-year programs based solely on SDI requirements. Research and technology for the SDI must not be traded every year against detailed operational needs. Finally, the SDI manager must be able to have direct and frequent access to national decision makers, as well as streamlined communications to the government and industry labs doing the work.

Many of my colleagues ask me why we are reopening an issue which they believed was forever closed during the ABM debate in the mid 1970's. First, I don't believe that the issue was ever closed for the Soviets. The data which we saw, and which I'm sure you will review in the months ahead, provided us with striking evidence that the Soviet Union has pursued with vigor all of the technologies we have recommended and many which we do not even understand yet. Secondly, those technologies which are essential to a truly effective defense against ballistic missiles are just emerging. In the 1960's and early 1970's we had no way to perform effectively boost-phase intercept; we had insufficient means to discriminate between decoys and warheads; we could not simultaneously manage thousands of engagements; and we were forced to consider the use of nuclear warheads at such low altitudes within the atmosphere that collateral damage to the defended area would have been substantial. Now, directed energy and even "hypervelocity" kinetic energy weapons appear promising for boost phase intercept. Precision sensors make unambiguous detection and discrimination of warheads from decoys and debris possible. New electronics advances make it possible both to manage tens of thousands of engagements simultaneously, but also, when coupled with precision sensors make it feasible to perform "hit-to-kill" intercepts without requiring nuclear warheads for the defense. These reasons provided the team with compelling rationales for reexamining the technical issues associated with achieving an effective ballistic missile defense.

The popular press has emphasized the exotic nature of certain technologies included in our study. I feel compelled to set the record straight on this illusion. Our recommended program does not concentrate on so-called "Star-Wars" weapons. The directed energy area, which I suppose has elicited the most such attention, is less than a fourth of the program. The largest portion of the recommended effort is to develop effective surveillance, acquisition, tracking, and assessment sensor systems. These technologies are vital to the nation not only with regard to strategic defense but also for strategic and tactical warning.

Many of my scientific colleagues (not in our study group) are skeptical about whether an effective ballistic missile defense is feasible. Moreover, many believe such systems would be prohibitively expensive. I would like to say at the outset that no one knows how effective defensive systems can be made, nor how much they might cost. I do know that the technologies we reviewed make such an

effective defense conceivable. Whether an effective defense is possible is the primary reason for embarking on the SDI program. With regard to cost, we do not known ultimate cost. But perhaps the major aspect of the investment in defensive technologies is to make it less expensive to stop a warhead than it is to get it to its target. Clearly, in such cases the cost tradeoffs from defensive deployments could favor them over offensive deployments.

One of the most important findings of our study was the critical nature of space element survivability. While, in the early stage of our effort, we do not know the extent to which space-deployments might be needed, it is likely that at least highly survivable surveillance and tracking sensors will be needed. While these systems must survive an opponent's first strike against them, this is a difficult but certainly a feasible task, and one which warrants considerably more effort than currently devoted to it. There is no magic offensive weapon which renders space systems unsurvivable. Popular countermeasures such as the so-called "space-mines" may be countered through both tactics and technology. For example, spacecraft may be placed at such depths in space that it may take many hours or even days to reach them.

Another often stated opinion is the idea that any defensive deployment could readily and cheaply be countered. We looked at the countermeasure issue very carefully, and we believe that the technologies we are working on will lead to a multi-tiered system which is extremely difficult to countermeasure. For example, we will be working on surveillance technologies which would observe a potential target using multi-colored infrared, visible, and radar radiation. Although a decoy could be cheaply constructed which would mimic a warhead to any single sensor, a decoy which would mimic real warheads for a variety of sensors would be almost as heavy and sophisticated as an actual warhead. There is thus no incentive or payoff to an opponent in proliferating such decoys. Similarly, an attacking missile might be successfully launched against a single weapon, for example a laser, at the cost of considerable decrease in payload and accuracy. However, other weapons, perhaps a missile launched kinetic interceptor, would be unaffected by the same countermeasures. The combination of different weapons and sensors in three or more layers would at the minimum drive an opponent to extremely expensive, and significantly less capable missiles, a positive result in its own right. These questions and options have, therefore, played a central role in our recommended research and technology program.

Some of my scientific colleagues are concerned that a focused US strategic defense research program could be both destabilizing and lead to a dangerous space arms race. The Future Security Strategy Study, the policy counterpart to our Defensive Technologies Study, considered these issues in detail and came to a wholly different conclusion. However, from my perspective I do not feel that these opinions are directly relevant to the program we proposed. The Soviet Union has pursued defensive technologies at the "technology limited" pace for several decades. It is unlikely, since it is technology-limited, that they could accelerate their effort more than they have, whatever we do. How a US effort could incite them to greater efforts in defensive technologies is unclear.

At the close of our study we worked out a summary statement for our work. I would like to relay portions of it to you because it succinctly states the opinions of those Americans most familiar with the technologies of strategic missile defense:

"The Defensive Technologies Study Team reviewed, evaluated, and prioritized the technological issues underlying the ballistic missile defense of the continental United States and it allies. We reviewed a set of defense system concepts and supporting technologies in various stages of development and created both fiscally constrained and technology-limited programs to evaluate these technologies."

"We took an optimistic view of newly emerging technologies and with this viewpoint concluded that a robust, multitiered ballistic missile defense system can eventually be made to work. The ultimate utility, effectiveness, cost complexity, and degree of technical risk in this system will depend not only on the technology itself, but also on the extent to which the Soviet Union either agrees to mutual defense arrangements or offense limitations."

"We urge that a vigorous research and technology program, broadly based but highly goal oriented, be pursued. This program would permit informed decisions on whether to initiate, in the early 1990s, an engineering validation phase leading to a deployed defensive capability after the year 2000. Certain intermediate technologies can, and should be demonstrated as part of the evolutionary research and technology program."

In closing, I would like to leave you with two opposite but equally compelling rationales for proceeding with our recommended program. From a pessimistic view, for an opponent to achieve effective missile defenses without a corresponding US defensive capability would, as I said earlier, be catastrophic to our strategic posture. Our technological analyses this summer showed us that effective defenses are now conceivable. Available data shows us that the Soviet Union is already pursuing these technologies at the fastest pace which their technology allows. The United States and its allies must, at a minimum, pursue a vigorous research and technology program to provide future governments with information on possible defensive moves by our opponents. From an optimistic viewpoint, which I share, strategic relationships based on a balance of offensive and defensive forces is not only morally correct, but can lead to a safer world. The awesome threat of nuclear weapons can only be lessened if we have in hand technical capabilities at least as valuable as the nuclear armed ballistic missile. Our work has shown that defensive technologies offer a rich promise for such capabilities. The Strategic Defense Initiative will provide future options for the nation to enhance our and our childrens safety and security. There is no way to avoid facing this issue—the program deserves your strong support.

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PREPARED STATEMENT BY DR. HAROLD M. AGNEW, PRESIDENT, GA TECHNOLOGIES, INC., VICE CHAIRMAN, DEFENSIVE TECHNOLOGIES STUDY TEAM

I am honored to provide testimony for your deliberations on the Strategic Defense Initiative (SDI). I was the Vice Chairman for the Defensive Technologies Study which I understand is the technical basis of the SDI. By way of background, I am currently the President of GA Technologies Inc., and I am a former director of Los Alamos National Laboratory. I share the view of the Defensive Technology Study Team (DTST) that research on the technologies included under the SDI is vital to the future security of the United States and its allies.

The reasons for embarking on the SDI take two equally important forms. First, it is absolutely clear to me that our adversaries have been pursuing a complete spectrum of defensive technologies, passive and active, at the maximum pace possible. If the Soviet Union were to deploy a militarily effective ballistic missile defense system without a corresponding US and allied capability, our security would be in grave danger. From a second perspective, I see the promise of extremely effective ballistic missile defense in the technologies we will pursue. Our study showed us something we would not have believed a few short years ago. New technologies in such diverse areas as directed energy weapons, precision sensors, microelectronics and advanced kinetic weapons such as rail guns, make militarily effective ballistic missiles defense feasible. Unless we commit to a long term R&D program we will never be certain. I believe that the United States must embark upon a vigorous and focused research and technology program to provide the option for future Presidents to rely on defensive systems to supplement deterrence with a degree of assured survivability in the event deterrence fails. The hope of a safer world, based on strategic defense, fully justifies this essential effort. Achieving this promise will not be easy or near term. We must be dedicated to a long and sustained effort on these technologies, and other new ones which will undoubtedly become available as we move forward. As our efforts begin to bear fruit, I see enhanced opportunities for arms reduction and arms accords and a more stable world. Clearly meaningful arms reductions will make the defensive systems more effective and we must continue our efforts in this most important area.

I fear that we might be reticent about pursuing some of the new technologies for fear that a focused defensive technologies effort might trigger renewed efforts by our adversaries in this area. I fail to see how our effort can incite more vigorous pursuit of these technologies than is already going on in the Soviet Union.

I fully appreciate that we must be realistic about expenditures and therefore I would like to underscore several technical areas which have critical importance to the United States both as they relate to the SDI and to other vital national needs. The absolutely critical issue of survivability for space surveillance sensors and their ground systems is one we cannot ignore. We must pursue this question at the highest priority since the viability of most effective ballistic missile defense schemes requires that we at least have highly survivable space-based sensors together with their ground systems. Moreover, whether we ever choose to deploy ballistic missile defense systems or not, we must have reliable and sur-

vivable boost-phase detection sensor systems to preserve our current deterrent. Related to this issue is our urgent need for a survivable command, control and communications ($C^3$) system. Our ability to perform ballistic missile defense depends on this aspect as does our ability to conduct any military operation. A third vital area is the need to generate power of many megawatts in space. Our best current space power systems, based on solar panels, produce a few kilowatts. The advanced weapons and even the surveillance and battle management systems needed for ballistic missile defense will use orders of magnitude more power than we can currently achieve. But beyond the power requirements for SDI, continued scientific exploration of the solar system and eventually industrialization of space must have power sources similar to those to be developed by the SDI. Although to me these three technical areas are of paramount importance, there are many other technical needs which will be pursued under the SDI which also have far reaching importance for the United States.

I believe that the Strategic Defense Initiative warrants your full support. The technologies to be pursued under its auspices are critical to the future security of the United States and the stability of the world. I must stress, as did the DTST, the importance of central management for the SDI. Work on these new technologies must be centrally planned, budgeted, and controlled or we will not have them available when we need them, either for ballistic missile defense or any other national need. We must vigorously pursue the SDI as they contain the seeds for a safer world. The Defensive Technologies Study showed that an effective defense against ballistic missiles was conceivable; the SDI will show whether it is realizable.

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PREPARED STATEMENT BY GEROLD YONAS, CHAIRMAN, DIRECTED ENERGY WEAPONS PANEL, DEFENSIVE TECHNOLOGIES STUDY TEAM, DIRECTOR, PULSED POWER SCIENCE, SANDIA NATIONAL LABORATORIES, ALBUQUERQUE, NM

As Chairman of the Directed Energy Weapons Panel of the Defensive Technology Study Team (DTST), I, along with my colleagues from industry, government, and national laboratories, had the opportunity to review and evaluate the status of the threat and our present defense technology research programs, and then to prepare a plan for the future. This plan described a program of research, technology development, and demonstrations to provide future options for achieving enhanced deterrence through defense against ballistic missiles. Many of us were skeptical about our present state of defensive technology, but were equally skeptical about our apparent commitment to assured retaliation for the indefinite future. We sought a combination of technology and strategy that could lead to a more stable equation. Until now, offensive initiatives have caused further responses involving increased offensive capabilities. With truly credible defensive technology, we could, hopefully, make a shift to a strategy that would make further offensive escalation unattractive.

We began by evaluating not only the present threat, but assumed that the threat would be modified in a responsive way. We were forced to postulate not only a robust defense, but also a very capable and determined offense. The difficulty was to evaluate the moves and counter-moves in a complex scenario that might lead to a favorable solution. The optimists and pessimists among us saw things quite differently, but we did agree that there were still too many unknowns to shift away from an offensive dominated strategy now. The program we developed was, therefore, not one of early deployment, for we concluded that their initial response would be to successfully countermeasure our near term defense capabilities. We considered responses that included the following: proliferating boosters, RVs, and penetration aids; extensive hardening; modifying boosters to burn out earlier and at lower altitudes; and attacking our space defenses. We knew that a capable defense would introduce enough uncertainty in the success of an offensive strike to serve as a deterrent; however, a capable defense would require very substantial increases in the capability of all elements of our ballistic missile defense technology.

The study team defined the key technology building blocks and identified the highest leverage aspects for early emphasis:

1. Target acquisition, discrimination, and tracking; weapon pointing, and kill assessment.
2. Battle management computers and software; $C^3$.
3. Survival of space assets and verifiable lethality against hardened targets.
4. Kinetic energy weapons, directed energy weapons and power supplies.

5. Utility and cost exchange assessment including implications of countermeasures and arms control.

As one can readily see, although beam weapons get a great deal of publicity, they only constitute one portion of the program. Nevertheless, directed energy, or "speed of light," weapons are on the critical path to a successful capability to counter missiles shortly after they are launched, the boost phase. Because of the limited time for engagement over vast areas, an ideal booster kill weapon should have long range, high rate of fire, and provide a "low cost" and verifiable kill. A favorable cost exchange is needed to discourage further increases in the number of boosters. Fortunately, a burning booster is a bright object, difficult to decoy, and may be difficult to harden against a capable beam weapon. The following types of beam weapons were considered: (1) space based lasers, (2) ground based lasers, (3) space based particle beams, and (4) nuclear directed energy weapons.

For each of these approaches, there were critical unknowns that demanded additional experimental and theoretical research in order to define their present limitations and ultimate potential. The figure of merit that applied to all of these concepts was the beam brightness, i.e., that power or energy that could be directed in a pencil-thin beam. For a laser, this is determined by the power of the laser, its wavelength, and the size, quality, and pointing accuracy of its optics. We found that there was considerable room for improvement in many of these characteristics. Optimistically, we concluded that we could achieve the needed parameters, but only a concerted effort would give us the definite answers. For particle beams and nuclear driven weapons, there were similar as well as new questions and program plan was developed to resolve the key technical issues.

Thus, we envisioned pursuing a broadly based, but highly goal-oriented science and technology program. The activity will take several years and will make severe demands on our technical creativity and dedication. It is likely that there will be surprises including setbacks as well as favorable discoveries of new and innovative approaches. The implications of this evolving technology and its relation to strategy and policy will also have to be reevaluated as we proceed. As we learn the limits of the technology and the threat response, there will be a constant winnowing process. Our emphasis will focus on the optimum approaches as the design objectives become fixed and technical elements are proven at a suitable scale. The desired approach will be to avoid costly mistakes in the engineering prototype phase through a complete assessment at the end of the present research phase.

We cannot now make the decision to deploy or even to begin to produce a defensive weapon system, but we should work toward an informed decision on whether to embark on the engineering phase in the next decade. We don't see fundamental reasons why it can't be done, and with the enthusiastic involvement of our technical community in meeting this challenge, we may even find that nature will make the road easier than we now envision. If that happens, then we can, before this century ends, begin to construct a more stable future wherein assured retaliation is constrained and balanced by systems that are defensive.

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PREPARED STATEMENT BY DR. EDWARD T. GERRY, SYSTEMS CONCEPTS PANEL, DEFENSIVE TECHNOLOGIES STUDY TEAM

I am very pleased to provide testimony for your deliberations on the SDI. In the Defensive Technologies Study which preceded the SDI, I was chairman, boost-phase systems concepts, within the overall system concepts group chaired by Dr. Fletcher. I am currently President of W. J. Schafer Associates, Inc. and previously served as assistant director in the Strategic Technology Office of DARPA where I was responsible for DARPA's programs in space object imaging, space surveillance, and directed energy. I have been associated with the application of directed energy to strategic defense since the invention of the high power gasdynamic laser in the mid 60's. However, in the recent public discussion of the President's initiative. I believe that far too much emphasis has been placed on the exotic directed energy technologies. The President's Strategic Defense Initiative is much broader. The goal is to focus a broad range of programs to build a technological basis for a fundamental long-term shift in our strategy for continued deterrence of nuclear war.

I believe that the development of politically and technically supportable alternatives for continued deterrence of nuclear conflict into the next century is long overdue. Deterrence based on purely offensive technologies appears increasingly less credible as time goes on, both politically and technically. At the same time, options for implementing an effective defense have become more numerous and technology advances over the last 20 years may have made feasible several of those options that seemed beyond reach a decade ago.

The National Security Decision Directive initiating the study chaired by Dr. Fletcher called for the group to define a long term R&D program aimed at the ultimate goal of defending the U.S. and its allies against ballistic missiles. The Systems Concepts Group recognized from the outset that a completely leakproof defense is certainly impractical if not impossible and that a layered or multitier defense makes the best use of imperfect systems. We also recognized that defensive deterrence does not require a perfect system, only that the defense operate well enough to deny an adversary confidence that any useful military objective can be achieved through the use of its ballistic missile forces.

In this context we evaluated the wide array of near and far term technologies appropriate to each of the layers and found many combinations that if successfully developed would achieve low leakage, not only for the current threat but for a future threat designed to stress the defensive systems. We found that specifying the correct technology goals was extremely important to defining a system that was robust to countermeasures and potentially affordable in the long run. For example, designing a homing rocket vehicle for either midcourse RV intercept or boost phase intercept with too heavy a homing head drives the size, weight and cost of the rest of the system to the point of impracticality. However, modern microelectronics coupled with space based sensors and designators allow the possibility of a very small, low cost interceptor which might radically change the traditional cost exchange between offense and defense. Similarly a laser boost-phase system designed at too low a technology level may be vulnerable to retrofit hardening of the ICBM targets, while one designed at the other extreme may be too costly for the extra performance achieved.

I would observe that many of the negative arguments on the feasibility of ballistic missile defense that have appeared recently in various articles are simply based on poor choices of technology level, which of course yields poor performance. The Systems Concepts Group worked very closely with all of the technology panels to develop technology development objectives and approriate demonstration plans to provide the technological basis for a decision on defensive system viability in the early nineties. These plans were an important input to the SDI technology program you have before you where the emphasis is on overcoming technology barriers rather than developing a near-term capability.

It is important to note that the current program is not aimed at developing or deploying a system at all. It is a focussed technology program which will allow an informed, technologically sound decision on whether a change of strategy for deterrence is possible and affordable.

This information, coupled with the parallel policy evaluations, will determine whether such a change is desirable. It will also provide the U.S. the basis for avoiding technological surprise by the Soviets resulting from their known aggressive pursuit of defensive technologies.

I believe that the President's Strategic Defense Initiative may well prove to be of historic importance. I am optimistic that much of the technology development and demonstrations will be successful and that we will be able to seriously consider a more balanced strategy for deterrence that can maintain stability well into the next century. Whether or not you share my optimism about the ultimate outcome, we must understand the technological possibilities that might be available to the U.S. and the Soviet Union. In pursuit of this premise, the SDI program has been structured to provide the basis for informed decisions. I urge your full support for this program.

Dr. DeLauer. With that, Mr. Chairman, we are ready to answer questions.

Senator Goldwater. Thank you.

Senator Nunn?

Senator Nunn. Thank you, Mr. Chairman.

Dr. DeLauer, if I understand what you are saying, you are talking about a 5-year program that will cost approximately $24 or $25 billion, in that range, and you are talking about a program that will give us the capability of providing, in your words, the evidentiary basis for informed decision on whether and how to proceed at the end of that timeframe?

Dr. DeLauer. Yes, sir.

Senator Nunn. You do not have any firm idea of what the total cost will be?

I suppose that is one of the elements you are proceeding to determine?

Dr. DeLauer. That is right.

Senator Nunn. I am sure we will get into details and not just in this hearing, but in the future. I think I heard you say in the testimony, both in closed and in open sessions, and Dr. Ikle, too, as well as Dr. Cooper, that one of the conceptual goals is to make Soviet offensive planning and attack more difficult.

Is that a fair assessment, that that would be one goal of our research?

Dr. DeLauer. Yes, sir. I think this will do that.

Senator Nunn. Another goal, as I understand it, is to preserve our capability to retaliate; in other words, the goal of being able to better protect our retaliatory capability?

Dr. DeLauer. Yes, sir.

Senator Nunn. That will include missiles and bombers?

Dr. DeLauer. The strategic defense initiative is a technology program against ballistic missiles, not against air-breathing threat.

Senator Nunn. Does this include only land-based offensives?

Dr. DeLauer. No.

Senator Nunn. Any kind of offensive missile threat?

Dr. DeLauer. That is right.

Senator Nunn. What I was saying, protecting our bombers and missiles against their offensive missiles?

Dr. DeLauer. That is right.

Senator Nunn. It would really protect any of our assets, bombers, missiles, submarines?

Dr. DeLauer. There is no question about that. With the effort we are doing in surveillance, that provides enough early warning in many situations to be able to handle our air-breathing assets, our bombers, by dispersion and by getting them off the fields.

Senator Nunn. Let me ask if this is another goal.

Would you say that it would be fair that this goal is also to avoid the necessity of threatening instant retaliation in response to a Soviet offensive threat?

Dr. DeLauer. The strategy for utilization of this force, I think, provides a broader capability for the NCA to have options.

If, indeed, it enhances the survivability of our assets, then it ought to provide him a greater degree of freedom and choice in utilization of these assets.

Senator Nunn. Can you envision our having a system that would avoid the necessity of deploying our offensive forces?

Dr. DeLauer. No.

Senator Nunn. Does anyone?

Dr. IKLE. Not in the foreseeable future. If you moved into an entirely different situation in the next century, where you would have a combination of agreement and defenses, that would be a different world.

Senator NUNN. One of the President's goals, as I understand it, in his initial thrust and speech was to avoid the necessity of having offensive retaliatory forces. It is a very attractive concept to say we can develop a defensive system that will avoid offensive forces on our side and perhaps even on their side.

Is that anywhere in the ballpark of what we are talking about?

Mr. IKLE. The President's statement focused on ballistic missiles and ballistic missile defenses. It still left open the air-breathing deterrent and air-breathing attack.

Senator NUNN. Let us confine it to offensive systems.

Can anyone visualize in the next 25 years timeframe that we will have good defensive capability if everything works out, and that we would then not have to rely on retaliation with offensive missiles ourselves?

Does anyone envision that?

Dr. DELAUER. I am getting long in the tooth. I can say within my lifetime I don't envision that nuclear weapons will be completely eliminated. Nevertheless, I believe that the research program we are proposing offers the promise of moving us toward a time when significantly reduced reliance on such weapons could be possible.

Dr. COOPER. Senator Nunn, I think it is fair to say that there is no combination of gold or platinum bullets that we see in our technology arsenal that we are pursuing in this program that would make it possible to do away with our strategic offensive ICBM forces.

Senator NUNN. I think that is clear.

Dr. COOPER. But, sir, let me add to that. There is a small percent of our program, about 5 percent of the dollars, that you will allocate that will be used to explore advanced concepts, a number of which were uncovered by the Fletcher committee, which could provide an entirely new silver bullet, which could make ballistic missiles irrelevant for the future.

There is a hope. The hope was translated into dollars at the 5-percent level, risk versus payoff in our program. But the hope is there.

Senator NUNN. Are you talking about 100 years from now?

I know Dr. DeLauer plans on living another 30 or 40.

What are you talking about?

Dr. DELAUER. Not in this environment, I am not. [Laughter.]

Senator NUNN. You are pretty relaxed. I have never seen you tense.

Dr. IKLE. Forty years ago there were no nuclear weapons. Things do change.

Senator NUNN. No doubt about it.

What the President said in his television speech was:

**If free people could live in security and knowledge that that security did not rest upon the threat of instant U.S. retaliation to deter Soviet attack, we would interdict and destroy strategic missiles before they reached our shores and our allies, would it not be better to save lives than avenge them?**

I certainly agree it would be much better to save lives than avenge them.

I don't think you are describing a program here that in any way diminishes the necessity of our retaliatory threat to avenge as well as to save. Are you?

Dr. DeLauer. We have argued that it is a deterrent. The minute you start talking about deployment——

Senator Nunn. The President was talking about what we have done when they have already fired, deterrence has not worked. He is talking about basically holding out to free people we are going to do away with the necessity of avenging, that is, retaliating.

I am trying to get the concept. If that is part of what we are talking about now, we ought to make it clear.

Dr. Ikle. Senator, things aren't black and white. There is often a mixture.

In the 1950's, which we all remember, we had substantial defensive capability and the time and ambition to make that defensive capability nearly perfect. Yet we relied on deterrent strikes of the Strategic Air Command.

Senator Nunn. Agreed.

Dr. Ikle. It reduced the likelihood of mass destruction.

Yes, we have deterrence in a defensive system.

Senator Nunn. If everybody agrees we are talking about an 8- or 9-year program before we reach the point of decisionmaking, we are going to have to have support from this administration and the next administration, Democrat or Republican, liberals or conservatives, if this money we are spending, $24 or $25 billion, is not going to be just an empty dumping out of money.

You have to have a long-term program. The concept of where you are going is enormously important. If the American people believe they are supporting a program based on doing away with offensive weapons, which I think everybody has stipulated here will not happen in Dick DeLauer's time, that is one thing.

When they wake up and find out that is not what we are going to be doing—we will go for both offensive and defensive—they will have a change of heart.

I have not heard population protection mentioned anywhere in any of these presentations.

Are you talking about a system to protect populations and U.S. cities?

Dr. DeLauer. Let me answer it this way.

What we are trying to do is enhance deterrence. If you enhance deterrence, and if your deterrence is credible and it holds, the people are protected.

Senator Nunn. That is also true of massive retaliation, that is a deterrent. Any deterrent system that prevents nuclear war will protect the population.

We are talking about systems where the deterrent has failed and missiles are flying.

Dr. DeLauer. Let us talk about that. If you have a terminal defense, the chances of protecting everyone is limited.

If you have a midcourse defense system, then the question of consequences on the population depends on the leakage. But the chances for serious effects for intercepting and destroying nuclear warheads, even with salvage fusing, if done in the midcourse, the consequences on the ground are very, very small.

If you get them in the boost phase, the leakage is so much less that the end result is protection of the population.

Senator NUNN. I would agree with that to some extent. As you know, there is an enormous difference in designing systems to protect missile fields, bombers, and so forth, where you have 50-percent, even 30- to 40-percent survivability, and can then retaliate.

That is one concept of things and a lot of us have supported that concept for a long time.

It is a different thing when you are protecting a population where 30-percent leakage or 30-percent failure basically means 200 or 300 American cities at least are destroyed.

It seems to me we had better make it clear if the collateral benefits are to protect populations, that is one thing, but if the concept that we are striving for is population protection, I think we ought to know that now.

If that indeed is a part of our major thrust to protect populations, I would like to know it.

Dr. IKLE. Let me shed some light on the question.

Senator NUNN. Could I ask Dr. DeLauer.

You are describing possible collateral benefits as incidental to protecting populations.

Is that a fair assesment?

Dr. DELAUER. That is one consequence of a boost-phase defense system. I think it is unlikely at this stage of the game that I could give you a definitive answer.

Depending on the consequences of this program, the result can very well be that a deployment decision could indeed be for the purpose of preventing attack on cities and, therefore, populations.

I don't know. That is what we are going to find out. When you deploy the system is when I can come in and answer you and say, "Look, the system we deployed is for the purpose of protecting the population," or "No, it is for the purpose of protecting and enhancing the survivability of our military assets," which are the two limits you propose.

Senator NUNN. You are not sure now that will be a goal?

Dr. DELAUER. Only when we know the answer as to what we get.

Dr. IKLE. One of the things we are afraid of here is deliberate Soviet attack. Deliberate Soviet attack, if there is a rational purpose of any kind, will be to go after our military systems, our nuclear forces of all kinds rather than our cities.

In that sense the bonus effect of a defensive system for protecting the cities could be very substantial because it will make so much harder deliberate Soviet attack against our overall military system, not just our nuclear forces.

Second, you have to consider other sources of nuclear destruction than a coordinated deliberate Soviet attack.

So, there are other contingencies short of what Dr. DeLauer described. Those are contingencies where population protection would be very significant.

Senator GOLDWATER. I think we have to take a practical look at this right at the outset. This is probably the biggest project this country has ever been asked to fund.

You don't know how much it is going to cost. We don't know how much it is going to cost. You don't even have an idea.

I remind you that 25 years ago we had a pretty good ballistic missile defense system and the Congress saw fit to not only slow progress on it, but destroyed it, not completely, but essentially.

We are faced, in my own opinion, with a threat far more destructive than anything that Russia might throw at us in missiles and that is our deficit. I think they are faced with the same thing.

In my opinion, the Soviets are developing and producing defensive weapons, while we investigate systems that are neither in existence, nor even in the stage where we can discuss them.

I have always believed that the best defense is a strong offense and I think that will be the case for a long time.

If we wander off into something too exotic, then I have strong feelings that it will never be financed by Congress. If we try to develop such a system at the expense of a proven offensive system, we will be making a mistake.

That doesn't mean that we should not go ahead with research in this field, but I think you people need to provide some cost estimates and come up with them pretty fast.

This Congress is already talking about big cuts in the defense budget. I think your first requirement is to come up with some cost estimates that we can discuss.

I have no other comments or questions at this time.

The 10-minute rule will be observed.

I recognize Senator Warner.

Senator WARNER. Thank you, Mr. Chairman.

I share the views of the Chair on the deficit. Nevertheless, I think this program is important and I intend to support it.

What my questions will endeavor to do is follow on Senator Nunn's perception of the problem with this program.

When the President spoke to the American people a year ago and thereafter, he left the lingering impression that this is something that Ronald Reagan thought up, and it is going to accelerate the arms race, and as such, we should not be joining in support of it.

In fact, we received this morning, in closed session, testimony about the intelligence situation and the justification for going forward with this program.

To what extent can the witnesses say in public, in open session, that the Soviet Union is ahead of us on this general program?

Dr. DELAUER. We have an unclassified summary of what was presented to you by the intelligence community.

Senator WARNER. That was not provided to the members of the committee?

Dr. DELAUER. No.

Senator WARNER. Where is it?

Dr. DELAUER. Right here.

Senator WARNER. That will not do any good for the record.

Dr. DELAUER. Let me summarize the programs that the intelligence community presented to us in closed session, and submit the unclassified summary for the record.

[The information follows:]

SOVIET STRATEGIC DEFENSE

**Strategic defenses are important to the Soviets' overall strategy for nuclear war. They believe that nuclear war could happen, and, if it does, they intend to do everything possible to survive and prevail. The operations of their defen-**

sive and offensive forces are closely coupled; offensive strikes would reduce the burden of the defensive forces. In the Soviet concept of a layered defense, effectiveness is achieved through multiple types of defensive capabilities compensating for shortcomings in individual systems. The Soviets have had massive development and deployment efforts in all strategic defensive areas, with the notable exception of antiballistic missile (ABM), where they agreed to limit deployment, but not R&D, in the 1972 ABM Treaty. Since then, they have made major improvements in their deployed strategic defenses.

The USSR has an improving potential for large-scale deployment of modernized ABM defenses beyond the 100-launcher Treaty limits. Should the Soviets abrogate the ABM Treaty, widespread ABM deployment to protect important installations in the USSR could be accomplished in the next 10 years because of the size and vigor of their R&D programs. Soviet developments occurring since the ABM Treaty was signed include the building of large, phased array radars with improved capabilities to provide target tracking data in support of an ABM deployment, an upgrading of existing Moscow-region ABM system, and continuing development of a new ABM system that could be fielded relatively rapidly. Also, they are deploying one surface-to-air missile system, the SA–10, and are flight testing another, a mobile SAM, the SA–X–12, both of which potentially could have capabilities to intercept some types of US ballistic missiles.

The Soviets have expectations that military applications of directed energy technologies hold promise of overcoming weaknesses in their conventional air and missile defenses. They have been working as long and more extensively than the United States on directed energy—laser, radio frequency, and particle-beam—technologies applicable to strategic weapons. Of the three types of potential directed energy weapons, the Soviet emphasis is on laser weapons.

The USSR's high energy laser program, which dates from the mid-1960's, is much larger than the US effort. They have built over half a dozen major R&D facilities and test ranges, and they have an estimated 10,000 scientists and engineers associated with the development of these weapons. They are developing chemical lasers and have continued to work on other high energy lasers having potential weapon applications—the gas dynamic laser and the electric discharge laser. They are also pursuing related laser weapon technologies such as efficient electrical power sources, and are pursuing capabilities to produce high-quality optical components. They have developed a rocket-driven magnetohydrodynamic (MHD) generator which produces 15 megawatts of short term electric power—a device that has no counterpart in the West. The scope of the USSR's laser weapon development activity is consistent with the comments of Soviet military spokesmen in the 1960's that the future of the USSR's military capabilities would depend on its success in developing advanced weapons, including laser weapons for ballistic missile defense.

In the late 1980's, they could have prototypes of ground- and space-based laser weapons for use against satellites and ballistic missiles. They may deploy operational systems of space-based lasers for antisatellite purposes in the 1990's, if their technology developments prove successful, and can be expected to pursue development of space-based laser systems for ballistic missile defense, for possible deployment after the year 2000.

The Soviets will continue their already vigorous programs for development of strategic defense applications of directed energy technologies, whatever the United States does or does not do about new defensive initiatives. Should they succeed in adding effective ground or space based laser weapons to their layered air and missile defenses, it would fundamentally change the U.S.-USSR strategic nuclear relationship.

Dr. DeLauer. They are embarked on a mobile antitactical ballistic missile with a surface-to-air capability that has applicability against ballistic missiles.

They are deploying a new radar which is an antiballistic missile radar. They are in a very large development program on lasers and particle beam technology.

Senator Warner. I don't want to lose my entire time by your reciting what will be put in the record.

Can you say the Soviet Union at the present time is ahead of the United States in this general category of defensive systems?

Dr. DeLauer. Yes.

Senator WARNER. They are?

Dr. DELAUER. That is right.

Senator WARNER. Assuming the Congress buys this program, how much time will it take for the United States to reach a position of parity or equivalence?

Dr. DELAUER. It will take about a decade.

Senator WARNER. Of the submission this year, $1.77 billion, how much of that represents a new initiative generated by the announcement of the President a year ago, and how much represents what was ongoing in our defense budget and would have gone on even if the President had not come out with a new name for this program?
on anyway?

Dr. DELAUER. It added $250 million.

Senator WARNER. Of the $1.77 billion, only a quarter of a billion dollars is new money generated solely because of this Presidential statement?

Dr. DELAUER. That is right.

Senator WARNER. In your judgment, and the three of you have been in the defense field a long time, would another President have had any other alternative but that which Ronald Reagan has come forward with at this time?

Dr. DELAUER. I can only speculate and say that many of these programs were started in the previous administration. This administration has examined those in detail and has continued them as a technology program because as defense planners, part of our job is to look at the threat on a continuing basis and determine how we match the threat.

I think what has happened with our President is that he has directed us to focus those technologies on an initiative which he calls the strategic defense initiative.

That is what we have done.

Senator WARNER. Any President confronted with Soviet intelligence on the situation at this time would be liable to make the same decision?

Dr. DELAUER. He could not rule it out.

Dr. IKLE. Prior to the evidence of Soviet violation of the ABM Treaty, you can see a President arguing that we can control this problem of defensive systems and stay welded to the concept which we had in 1970 saying that we limit offensive arms and abolish defensive arms.

But with the evidence which has come in about both the Soviet buildup and lack of Soviet restraint in the defensive side, I don't think that argument can be made any more.

Dr. COOPER. Looked at specifically from the standpoint of an R&D investment, it represents a 16-percent increase in technology areas that have wide applicability throughout other mission areas in defense.

So, it is entirely reasonable that any President would have decided to make similar increases in these technology areas even for other reasons.

Senator WARNER. Essentially he has made a prudent decision such that future Presidents can make follow-on decisions on whether or not such a system can be deployed in light of the strategic balance at that time; is that a correct statement?

Dr. DeLauer. That is a correct statement.

Dr. Ikle. Yes.

Senator Warner. Doctor Ikle, in your judgment, does this program represent an increase in the threat of a limited nuclear war?

Dr. Ikle. On the contrary, the Soviet ideas of limited nuclear war are to attack militarily important objectives. These are more easily defended than the country as a whole. It rather raises the threshold of limited nuclear war and denies options to the Soviets of limited war.

Senator Warner. Does it contribute to lessened tension and provide more stability?

Dr. Ikle. I believe that to get away from this confrontation of offensive missiles poised at each other is a way to go for a long-term relationship. This is a secular view looking to the next century.

Senator Warner. Dr. DeLauer?

Dr. DeLauer. I agree.

Senator Warner. Thank you, Mr. Chairman.

Senator Goldwater. Senator Kennedy?

Senator Kennedy. Thank you, Mr. Chairman.

I would just say at the outset of these hearings, Mr. Chairman, that many of us have been unwilling to accept what has been proposed by these witnesses as being technically feasible.

There has been a good deal of discussion and a good deal of debate concerning the program's technical feasibility by those who have been very much involved in the development of the most sophisticated weapon systems that we have developed.

I would certainly hope sometime during the course of the consideration by this committee that we may have an opportunity to hear from those who believe that this kind of development and this kind of scenario is completely unrealistic or, if it is possible to develop this kind of system, what it would really take so that we implications of this kind of proposal.

I would be interested in asking the witnesses what efforts have been made by the administration to challenge the Soviet Union to some restraints in this whole new area of the arms race?

There has been a very clear indication by the Congress in the past months of a desire to do so.

I was wondering what efforts had been made and what you are able to tell us about the administration's efforts to see if we can have some kind of restraint in the development of the new, what has been labeled as "Star Wars" technology?

Dr. Ikle. Senator, in the defense area, ballistic missile defense, we have a treaty which we consider still valid. You have been briefed about the Soviet radar that from all evidence is a violation of that treaty.

I believe you have been briefed about the discussions we have had with the Soviets, both through high level channels on this issue as well as related issues on the preservation of the ABM Treaty, and so far the response has not been satisfactory.

We do have to confront the evidence here that we are not able to convince them that they should continue restraint in this area.

Senator Kennedy. In the new strategic defense concept, what efforts have been made?

Can you specify those to the committee at this time?

Dr. IKLE. On the question of discussing things in the future, we have both agreed combining offensive and defensive. In that area we have proposed to the Soviets that we hold discussions either in the context of START or other appropriate forums and so far they have not wanted to do that yet.

There are informal discussions, but nothing has started yet.

Senator KENNEDY. Outside the START proposal, have there been efforts by the administration to see what limitations can be put on these new strategic defense systems?

Dr. IKLE. We first of all have to see whether we can have the Soviets abide by the treaties that they have already signed. Otherwise we cannot build new treaties with any confidence.

Senator KENNEDY. If you are prepared to say they don't comply with any treaties, you might as well say they are not going to move ahead with the START proposal or go back to the bargaining sessions.

Dr. IKLE. We have to try both.

Senator KENNEDY. That is what I understand. I haven't heard the President say that.

Quite to the contrary, Mr. Rowny said in spite of what he has reported as being potential violations of the ABM, that it has not altered the administration's position in trying to get some kind of agreement in START. He said it at that table there.

If there is a different position that you are stating today, I would like to know about it.

Dr. IKLE. We have to try both. We have to see that the treaties that are concluded have been observed and we have to propose new treaties.

Senator KENNEDY. I gather from what your answer is that there have been no new initiatives in this area to try and at least head off a new arms race in outer space as described in the "Star Wars" technology?

Dr. IKLE. The important thing is to curb the buildup of these offensive forces as was envisaged.

Senator KENNEDY. Your answer is no, there has not been?

Let us get the record straight.

Dr. IKLE. We have not started negotiations on a new antiballistic missile treaty because we have a treaty. We first have to get that observed.

Senator KENNEDY. With regard to any of the new kinds of technologies, the area where you have found the Soviet Union evidently ahead and the United States behind in which we are attempting to catch up, what efforts have been made to try to see if we can get any limitation in terms of those developments?

Have there been any outside of START?

Dr. IKLE. There are a number of areas where we try to induce the Soviets to curb their efforts, in areas where they are ahead. By and large, these efforts have been futile because the Soviets are not induced to cut back when they are ahead unless it is to their benefit. It is understandable.

Senator KENNEDY. If the defensive technologies are so compelling, why haven't we even under the ABM Treaty moved ahead and built our own ABM system as provided in the ABM Treaty?

Dr. DeLauer. We have been carrying on a development program whose objective was to handle the increasing capability of their offensive systems; that is, the MIRVing of their systems.

Senator Kennedy. I understand.

Dr. DeLauer. We have been carrying on that with the BMD. We have not gotten to that point of a deployment position. We have been concerned because, as we discussed, any system deployed under the current restrictions, with a limited number of interceptors, and so forth, would not be an effective capability at this time.

That is why we are embarked on this program. We are looking to see whether or not, in the existing treaty, there might be more options than just the kinetic type of capability.

Senator Kennedy. Why are you so worried about whether the Soviets are doing it?

Dr. DeLauer. Because I felt that over a period of time they don't have the same debate about the resources applied to deployment decisions as we do.

Dr. Cooper. The concern is the potential for rapid deployment. That is, they could suddenly spring full blown with a significant capability.

Senator Kennedy. Can I ask you, would this program, with the various alternatives, even maximized in the period of the future, be able to stop the cruise missiles or the bombers from penetrating the United States?

Dr. DeLauer. There are certain of the technologies that will be applicable to cruise missiles and bombers; that is, the air-breathing threat. These would include some of the surveillance systems, some of the battle management systems we are doing, one of the major efforts, to be sure we understand how to fit a system such as this in the military doctrine and military rules and systems we operate in.

That would be applicable to the air-breathing threat. The air-breathing threat per se from a kill standpoint is reasonably well in hand.

The subsonic cruise missiles can be handled by our present-day fighters.

Senator Kennedy. In terms of the penetration of the Soviet Union by American cruise systems, what percent of the cruise weapons do you think will be able to be handled by Soviet fighters?

Dr. DeLauer. I can't give you the percent.

Senator Kennedy. Well, a ballpark figure.

Dr. DeLauer. I think they could get 10 percent.

Senator Kennedy. Ninety percent could get through?

Dr. DeLauer. Yes.

Senator Kennedy. And the amount of kilotons on those cruise missiles?

Dr. DeLauer. That is a classified figure.

Senator Kennedy. It certainly is very significantly above what was dropped in Hiroshima.

Are you going to outline for us as well what the prospects would be in terms of cost for overcoming those kinds of defense systems in your testimony? We need some balance on what we are really getting in terms of our expenditures on the defense system, what you anticipate, or what you know that the Soviets have at this time in terms of being

able to overwhelm that system and what you anticipate in terms of the future?

Dr. DeLauer. Not in the testimony, Senator, but that is what we are here to request, the funds necessary for us to make those kinds of judgments.

First we have to find out just how effective is a system based on the technology we now have. We have to go through the planning and analysis that Senator Cohen talked about, we need to determine what is a reactive threat, what would they do, and how much would it cost us? What we have to do is see the balance on a cost-effective tradeoff.

That is what is going to come out. I think in future years as we discuss this program, those are the questions that naturally should be asked by the Congress.

You spend this money, this is one of your objectives, you said so, what is the answer?

I think it is incumbent on us or our successors to answer the questions as they come up, but I can't answer the question now. If we knew the answers, we wouldn't have to do all this work.

Senator Goldwater. Senator Quayle?

Senator Quayle. Thank you, Mr. Chairman.

I certainly support the idea of going ahead on research and finding out where we are. That is not to say we don't have any other choices but we need to go ahead and examine our potential.

I gather from your statement that is the bottom line of what we are talking about, that we don't have any other choice but to proceed in this direction.

What are our options or alternatives if we don't?

Dr. DeLauer. It is not a question of either this one or no other choices. I think there are other choices.

I think on the scale of both the ability to be able to convince people that they should spend a like amount of money on the choices and this one, I think it would be different. Certainly proliferation is a choice. That is an offensive thing instead of a defensive situation.

Back to the Kennedy thing. We can look to terminal defense only, and make a decision to deploy. That is a choice.

We think that perhaps this provides us a spectrum of options that we would be remiss to not at least address.

Dr. Ikle. Speaking of this question of options, if we do not default, our successors, your successors in this committee, we will be able to take advantage of opportunities for new negotiations and a new Soviet Government.

It was less than 40 years ago that we dealt with Adolf Hitler. Things can change in the world. You can choose to do no work on defensive options; it can be done, but it would not be prudent.

Dr. DeLauer. I think on the whole question of strategic systems, offense and defense, a certain amount of stability in the research and development options leads to a much better opportunity for clear choices in the future.

We have not done that. We have banked on one solution, or another solution, to the exclusion of other gradations that could probably help.

This is at least a step in the defensive area to be broader than to focus in on one solution at this time and then have the only option open to be cancellation or continuing.

Senator QUAYLE. I understand it certainly gives you more flexibility.

Dr. DELAUER. It gives you more flexibility, too.

Senator QUAYLE. When we get to the final decisionmaking point, when we have a considerable investment in research and development, $24 to $25 billion, and if at that stage it looks like we should go ahead, are you saying to the American public that there will be a tradeoff and we will be able to scale back in some areas of our strategic offensive forces?

Is this implicit in what you are saying that there is a tradeoff?

Dr. DELAUER. I think what is implicit is the fact that it might be an eventuality, but not a certainty. There might be some ways to trade that off at a future date.

Senator QUAYLE. If we were willing to trade it off and we make a commitment on defensive capability, where would the tradeoff come? What part of the triad would we be looking at for any kind of offset?

Dr. IKLE. For one thing you might be able to avoid adding to the present program of offensive forces to cope with the new threats. I don't think this tradeoff is a startling idea. We did it in the 1950's.

A large part of our defense budget was in strategic defense. A much larger part was in offensive forces.

Senator QUAYLE. So, you are basically saying that there may not be any tradeoff, you might have to have both more defensive and more offensive capabilities in the future?

Dr. IKLE. The overall level of the strategic budget within our defense program is something that has changed over time. It is very slightly larger now than it was 10 years ago. It is lower than it was in the fifties.

Within that level how much you put into offensive and defensive is a second tradeoff.

Senator QUAYLE. Let me ask one other question. Maybe you cannot answer this in open session.

We have been looking at these numbers that have been mentioned by a couple of other Senators. You are looking at a tremendous, tremendous cost, $24 billion, in research. Maybe we will and maybe we won't deploy a system.

If we are going to go ahead with a space-based defense, and also say we are going to increase strategic offense, I think it just won't add up, as far as our budgets are concerned.

As you look at some of these things, I hope we might be saying that there are some tradeoffs. If, in fact, we can get the technological investment in research necessary to do what we think should be done, I hope there will be tradeoffs, because I don't think we will be able to afford both.

Dr. IKLE. We certainly hope so.

Dr. DELAUER. There is no question about it.

Senator QUAYLE. What kind of launch capability would the United States have to have to put up a space-based defense?

Do we have that launch capability now or is this an area we will also have to make an investment in once we come to the decision to go forward?

Dr. COOPER. There are two views of that and that is an issue that will be resolved during this research program.

One view is that we can use the substantial capability in place represented by the shuttle and the manned space flight capability to take pieces that might be required of a ballistic missile defense system into space and assemble them there.

Another view is that we would have to assemble those components on the ground and launch them as an integrated whole, in which case we understand that it would probably require a new heavy-lift launch capability to be created.

Exactly how that is going to come out will be part of this program because an expensive part of our research program will be to determine the lowest cost way of acquiring the substantial defensive capability that the President seeks.

Senator QUAYLE. There is certainly the possibility that you are going to get into another heavy launch-type vehicle to get these things up there?

Dr. DELAUER. On the other hand, we don't have to invent it. In many cases we may not have to start from zero. There have been studies that have been presented to us, presented to NASA, on what is called the shuttle-derived launch vehicle, essentially using the assets of the shuttle system in different configurations that provide us with the capability to lift very heavy loads with essentially an expendable launch vehicle.

Senator QUAYLE. Thank you, Mr. Chairman.

Senator GOLDWATER. Senator Bingaman?

Senator BINGAMAN. Thank you, Mr. Chairman.

Let me ask if either Dr. Ikle or Dr. DeLauer or Dr. Cooper would support the requirement that the manager of this program have to have confirmation by the Senate?

Dr. DELAUER. That is something for the Secretary and the President to decide. I don't think it is proper for me. That is a question of whether the President feels that the job is one that has to have the confirmation in order for him to do the job.

I couldn't answer that, Senator.

Senator BINGAMAN. Let me ask about these new and innovative technologies that I think Dr. Cooper spoke about.

I have some testimony that Dr. Fletcher had prepared for today where he says, "We firmly believe that it is essential to preserve substantial resources, at least 5 percent, for new and innovative technologies."

This is this new silver bullet that I think you referred to when you were answering a question by Senator Nunn.

If cuts are to be made in the research funding you are asking for here, would it be your position that they should not be in that 5 percent that you have designated for these new and innovative technologies?

Dr. COOPER. Yes, sir. As a matter of fact, that was a recommendation of the Fletcher committee that at all costs the most advanced, the higher risk, but potentially the highest payoff, technologies should be precisely the ones we pursue first and that we should delay the more conventional technology development for which we have greater confidence.

In adjusting our program and in making the presentation to the President for the fiscal year 1985, we have taken that point of view and we have reallocated resources out of the more conventional areas into these higher risk, higher payoff technology areas.

Senator BINGAMAN. You would take the position that we should protect that 5 percent first?

Dr. COOPER. Yes.

Senator BINGAMAN. And if cuts have to be done, do them elsewhere?

Dr. COOPER. Yes, sir.

Senator BINGAMAN. Let me ask about the statements that were made earlier. The testimony was that the Soviets were 10 years ahead or a decade ahead in the development of these technologies, these weapons.

Is it true that we are ahead in the research needed to develop an effective system of this type or can you make any statement as to who is ahead with regard to the research needed to develop an effective system as distinct from just deploying an ABM system?

Dr. DELAUER. I think you have to start looking at some of the elements that we are discussing, such as signal processing, which ties in with battle management.

In the work we are doing in high-speed data processing, that is, signal processing, I think we are probably a little bit ahead.

In heavy launch vehicles, they are ahead of us. They have a program for a very large expendable launch vehicle, as well as the shuttle program, and they are ahead of us in that area.

On the question of the basic physics of lasers and laser devices, it is hard to say. You heard the briefing. It is a matter of judgment.

I think from a development standpoint they are ahead of us. Whether they are ahead of us from a scientific standpoint in understanding the phenomena, I think our physicists are as good as theirs and vice versa. We are about even.

It is a mixed bag, depending on which piece of the problem you want to have.

Dr. IKLE. One of the difficulties in answering the question is that there is a great deal of secrecy in the Soviet research establishment.

Dr. DELAUER. And what has been disappointing—not disappointing—but at least in this area, as you know, there has been a constant drumbeat for other solutions to the defense thing in the unclassified literature, for almost a half decade.

Senator BINGAMAN. Let me ask Dr. Ikle, in your written statement you say, "We recognize full well that there are many important uncertainties that will not be resolved until more is known about the technical characteristics of defensive systems."

You cited one of those uncertainties, Soviet response to U.S. initiatives.

What can any of the panel here tell us about what we would anticipate Soviet response to this strategic defense initiative to be, both in defensive and in offensive weapons?

Dr. IKLE. One possibility which we obviously want to pursue is that we might both agree to work toward a relationship where defensive systems are dominant and curb the offensive forces, the purpose of our START negotiations, and you can build on that, and go beyond.

To what extent the Soviets will respond is hard to say at this time. In 1960's when we argued with them that we should limited ballistic missile defenses first and then the offensive forces, they took the opposite position, and thought we were wrong. So, we changed sides.

The other question is how they would respond in countermeasures.

Dr. DELAUER. Let us assume that our solution was a space-based system of large magnitude. What if they kept us from doing so?

That is not hard to do if you are deliberate about it. We can do it and they can do it, in a reasonable altitude system, which is probably the one that would have to be looked at first.

If the guy wants to build something in your back yard, we both have access to it. It could be very, very difficult.

Now, whether that is probable, in light of its political implications and in world opinion or anything, that is beyond me.

Dr. IKLE. That is not likely because of the confrontation that it would produce, but there are other questions of how they would respond.

Dr. COOPER. From an engineering standpoint, a significant amount of the new money that Senator Warner spoke about, the $250 million, will be expended looking at damage and vulnerability of Soviet systems and what reactions, what engineering and technical reactions they could take to the kind of systems we could deploy that would render them not effective.

We then intend to create technology which is robust enough to be able to overcome any foreseeable countermeasure that the Soviets could take. We will be studying those countermeasures in great detail with some of the R&D funds which we have requested.

Senator BINGAMAN. That is all I have, Mr. Chairman.

Thank you.

Senator GOLDWATER. Senator Wilson?

Senator WILSON. Thank you, Mr. Chairman.

Gentlemen, I hope when the transcript is prepared you will take the time to read the responses you have made to Senator Nunn today. I must tell you that I am mystified and, frankly, angry because your written testimony is at variance with, certainly the tone and, I think, even the substance of some of the responses you made.

You have been talking about silver bullets and what hope there is that this can be more a bonus in terms of protecting the cities.

Let me ask you if you disagree in any way with the rather high optimism which has been expressed by Dr. Fletcher, as recently as last week, in his testimony to the House that multitiered ballistic missile defensive systems can be made to work?

Dr. DELAUER. We don't disagree with him at all.

Senator WILSON. If you agree with that, isn't it true that necessarily includes a boost-phase system which will have a potential to avoid the leakage that we are worried about with respect to 200 or 300 American cities?

Dr. DELAUER. I don't think Dr. Fletcher replied in response that it was a necessary condition that we have a boost-phase intercept capability and boost-phase defensive system to have a robust defense system.

Senator WILSON. It is a robust multitiered system.

Dr. DELAUER. I just don't want to have a misunderstanding in regard to expectations that it cannot be made at the present time.

Senator WILSON. I think you are so concerned about that, you expressed such overwhelming caution in that respect that, in fact, you have given entirely the wrong tone in your response to Senator Nunn.

Dr. DELAUER. I am sorry that is the impression you have.

My concern is just as I have expressed to Senator Cohen. I don't want this issue to be so narrowly focused and narrowly sliced that a very, very high degree of expectation is going to therefore preclude

doing something else and we will be up here 2 weeks from now talking about the strategic offensive system and then they will say, "Look, what you just said. We won't need it."

That is my concern, if we can have a balance close to this.

Senator WILSON. Let us be clear that it will be necessary during intervals until such time as this robust multisystem can be achieved to maintain the existing deterrence?

Dr. DELAUER. That is what I was trying to convey, absolutely.

Senator WILSON. I don't think that is what you did convey. I think you erred on the side of conservatism, which I am inclined to do myself.

What I am going to say to you is that I think we need to make clear for the record that this admittedly costly, admittedly somewhat ambitious research and development program is absolutely essential if we are to not only reach parity with the Soviets in 10 years, but if we are, in fact, to reach the full potential that Dr. Fletcher's report envisages.

That is the only way we can get off the nuclear treadmill.

Dr. DELAUER. That is right.

Senator WILSON. It is an accurate statement to say that ultimately, if his optimism is justified, we are going to come to that time when we do offer the American people the promise of enormously reduced reliance upon retaliation and, therefore, reduced reliance on offensive deterrence.

Dr. IKLE. Senator Nunn made the same point.

Dr. DELAUER. We will be very careful to edit the transcript.

Dr. COOPER. May I clarify the remark I made on that issue?

I said that basically we see nothing in our technology basket that would make it possible for us to say today that there will be a time certain in the future when we can do away with all of our strategic defensive forces.

We hold out the hope that that could happen, but we don't see it today. You have to realize that in order to guarantee to the population of the United States that they would be safe from the threat of ballistic missiles, we would have to build a perfect defense system, no leakage.

We don't see the combination of technology we have today guaranteeing that. But we hold out the hope that we can do that. There is some optimistic view that that will be possible at some time in the future.

We certainly will strive to accomplish that. Even short of that, with some remaining strategic offensive forces, the combination of the deterrent capability of that highly capable, although slightly leaky, system that we might foresee in the future and a very small number of strategic offensive forces could be an incredible deterrent to nuclear war and would substantially achieve the President's goal.

Senator WILSON. I wish you had said it with precisely that clarity earlier. I think you are going to have to say that because otherwise you are going to find there isn't support for the kind of R&D that is essential.

Thank you, Mr. Chairman.

Senator GOLDWATER. Gentlemen, we want to thank you for coming this morning. Your testimony has been very interesting.

Frankly, speaking as a member of this committee, I wish the President had not announced this proposal to counter the awesome mili-

tary threat. I think he would have been better off if he said, "Go back and study this issue and see if we can afford this system."

Now we are pretty much committed to the most expensive system that has ever come down the pike.

I have a hunch you would much rather have had it that way, too.

I have a feeling within the next month or so we are going to ask you back to give us a better estimate of what this system will cost, how long it will take, and any particular problems you envision.

I thank you, especially on behalf of the chairman, Senator Tower, who has been detained.

Dr. DELAUER. Thank you, Mr. Chairman.

[Questions and answers submitted for the record follow:]

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

STRATEGIC DEFENSE INITIATIVE

Senator THURMOND. President Reagan made a bold move when he announced that the United States would move to a policy of defense rather than revenge to maintain deterrence.

The United States has long relied on a retaliatory capability that would give even the most aggressive Soviet planner pause.

By cheating on arms control agreements, using legal and illegal technology transfers, and funding without constraint their strategic programs, the Soviets are approaching a point where the President of the United States may doubt our ability to inflict unacceptable damage under certain attack scenarios.

The briefing recently presented to the Subcommittee on Strategic and Theater Nuclear Forces by the CIA is very alarming.

Members of Congress who doubt Soviet intentions should ask for this briefing in detail.

Leonid Brezhnev once stated that the correlation of forces would shift by 1985 so that the Soviet Union could exert its will where and when it desired.

The Soviets will not reach that level by 1985, but it is most certainly an objective. Therefore, it is in our best interest to proceed with our Strategic Defense Initiative in a timely manner.

Dr. LeLauer, you have received some rather unfair criticism for supposed disloyalty to the President in the area of strategic defense. I know there is a great deal of risk involved with the technology necessary to develop a strategic defense system.

Do you feel that the cost estimates projected in the five-year defense plan are realistic?

Dr. DELAUER. We believe that the cost estimates are as realistic as it is possible to make them, considering that we are in the early stages of concept development and require many answers which only more research will yield. One of the objectives of the research will be the identification of realistic costs for systems development, production, deployment, and operation of such systems so that an informed decision about system development can be made in the early 1990's.

SOVIET RESEARCH AND DEVELOPMENT

Senator THURMOND. The Soviets have spent a great deal of money in research and development for various forms of strategic defense systems. What is your best estimate for a Soviet deployment of such a system?

Answer. [Deleted.]

DEFENSE SYSTEM EFFECTIVENESS

Senator THURMOND. Dr. Ikle, it has been stated that the United States would expect a strategic defense system to be more than 99 percent effective to be acceptable. How effective would a Soviet system have to be before the Soviets considered it acceptable?

Mr. IKLE. First, it should be said that we have not identified a particular level of effectiveness which a defense system would have to achieve before it could be considered acceptable. It is far too early to make that determination now.

We do believe, however, that defenses of a very high degree of effectiveness are possible. The ultimate goal of the SDI is to develop such defenses.

It is, of course, difficult to determine what level of effectiveness the Soviets would consider acceptable. We do know that the Soviets often field military systems of lesser capability which they upgrade frequently over the years. We also know that Soviet defensive technology efforts are not conducted with the same purpose as the SDI. Rather than looking to such technologies as a means of reducing the military and political utility of ballistic missiles, the Soviets see them as a means of ensuring a favorable military outcome for the Soviet Union in the event of a nuclear war.

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## Questions Submitted by Senator John Warner

### LIMITS ON BASIC RESEARCH

Senator Warner. The Strategic Defense Initiative at this point is limited to technology only. Is there any precedent in the arms control arena for putting limits on basic research technology What is your assessment of the feasibility of such limits? How would such limits be verified, for example?

Dr. DeLauer. Arms control agreements with the Soviet Union are only as good as their provisions for certifying compliance. To adopt agreements that are otherwise in the national interest, but which have inadequate verification procedures, is to court national disaster. Limits on basic, or laboratory, research have never been adopted as part of an arms control agreement because there is no adequate means by which compliance with such limits could be verified. The ABM Treaty, recognizing this fact, permits research—short of the field testing stage—on ABM technologies that the Treaty otherwise prohibits.

### STRATEGIC DEFENSE INITIATIVE

Senator Warner. Dr. DeLauer, what steps have been taken within the Strategic Defense Initiative to assure that the effort is closely linked with intelligence community activities?

Dr. DeLauer. Information on Soviet research into advanced technologies for ballistic missile defense is important for our understanding of their progress in developing such systems. Information on Soviet technology and their actions to harden their missiles and develop other countermeasures to potential U.S. BMD weapons is essential to our development of the requisite technologies for effective defenses. We continually keep all of the intelligence agencies apprised of our information needs, and they are supporting us within the limits of their capabilities and overall priorities.

[Deleted.]

### LEAK-PROOF DEFENSES AND DETERRENCE

Senator Warner. Mr. Ikle, would a strategic defense system have to be leak-proof in order for it to make a significant contribution to deterrence?

Mr. Ikle. No. To enhance deterrence, a defense system must be able to reduce the military utility of nuclear weapons. Defense systems can provide varying levels of defense coverage, which convey varying benefits for deterrence and stability. An effective defense against ballistic missiles can enhance deterrence and stability by denying an aggressor confidence in his ability to predict a successful attack outcome and by reducing or eliminating the utility of preemptive attacks on retaliatory forces. If such defenses were combined with effective air defenses they could reduce or eliminate the military utility of both ballistic missiles and air-borne nuclear weapons and thus significantly raise the threshold of nuclear conflict. In the extremely unlikely event, due to irrationality or accident, that such nuclear weapons would be used under these conditions, effective defenses could also make a major contribution to saving lives and reducing damage.

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## Questions Submitted by Senator Dan Quayle

### OFFENSIVE AND DEFENSIVE FORCE TRADE-OFFS

Senator Quayle. Mr. Ikle, in several of the statements submitted for today's hearing I notice that witnesses mention that it may be possible to moderate the development of future offensive systems if we field a defense against ballistic

missiles. At this stage, do you have any feel for which leg of the current strategic triad might be scaled back? Would we likely retain our bomber and submarine forces and reduce our number of more vulnerable ICBMs?

Mr. IKLE. In an environment in which the United States and the Soviet Union were both to deploy an effective defense against ballistic missiles, the force structure of both countries could be expected to deemphasize ballistic missiles and shift in the direction of bombers and cruise missiles, both airbased and submarine based. In the event of mutual deployments of effective air defenses, there would be strong incentives for reductions in these forces as well.

MAN-IN-THE-LOOP

Senator QUAYLE. Mr. Ikle, one of the phases described in the SDI concept is that of boost-phase intercept. I have been told by several credible sources that the Soviets could shorten their boost phase considerably with minimal effort. If that is the case, will a boost-phase intercept eliminate "man-in-the-loop" on deciding when to attack a launched vehicle rising out of the Soviet Union? In your opinion, can the U.S. or the Soviet Union ever afford to leave an essentially political/military decision to sophisticated data processing equipment?

Mr. IKLE. First, it should be noted that the Soviets could not significantly shorten the burn times on their boosters "with minimal effort." The Fletcher panel looked at this question and determined that it would require the Soviets to develop and deploy an entirely new generation of missile boosters to replace those that exist today and that such a tactic would also reduce the payload that their missiles could carry as well as reduce the accuracy of the missile warheads. However, if they were to do this, despite the drawbacks, political and military decisionmakers would still retain a central role in setting defense system policy and operations.

SOVIET RESPONSES TO U.S. DEFENSES

Senator QUAYLE. Mr. Ikle, at this time, what do you anticipate the Soviet response would be to the United States proceeding with full deployment of a space-based DABM? Do we have any reason to believe they could match our technology effort, or would they likely just expand their strategic offensive forces?

Mr. IKLE. We would hope that over the next several years as we look into the promise of defensive technologies that the Soviets will enter into agreements with us that will serve to regulate the mutual deployment of defensive systems. There is no reason to believe that the Soviets are not as capable as we of developing effective defenses, since they have for many years now devoted substantial financial, material and human resources to the task. In fact, they probably lead the United States in some of the appropriate technologies. If effective defenses against ballistic missiles can be developed, and we believe they can be, they will generate substantial disincentives against the proliferation of offensive arms.

STRATEGIC DEFENSE INITIATIVE

Senator QUAYLE. Dr. DeLauer, at this time, which directed energy technologies appear to hold the most promise for a DABM application?

Is there an emphasis in the SDI program towards spending the money on those technologies which look most promising, rather than conducting research across the board among many areas?

Dr. DELAUER. Directed energy technology is too immature to make a narrow selection of one or two technological alternatives for pursuit at this time. While some approaches, such as the continuous carbon-dioxide gas-dynamic laser, have been dropped, there are several lasers and particle beam generators under active consideration. We believe that pursuit of these alternative technologies should be continued until they reach sufficient maturity that an informed decision can be made to use them in weapon system development or to drop them from further consideration.

Senator QUAYLE. Dr. DeLauer, what is the Defense Department's and CIA's current net assessment of the research the Soviets have been conducting in the directed energy weapons field?

If they are ahead, how long will it take to catch up?

Is it your opinion that the Soviets are advanced enough in this area that they could "break out" on the United States and deploy an ABM system before we could respond?

Dr. DELAUER. [Deleted].

Senator QUAYLE. Dr. DeLauer, how will the SDI address the question of defending our space-based assets in the event we field a system in outer space?

Do you believe that any such system will be survivable enough to function as the only defense the United States will have against Soviet ICBM's?

Dr. DELAUER. We recognize that devising tactics and technologies to ensure that SDI system elements remain operationally effective during conflict will be one of the most important and challenging tasks facing the SDI program. The members of the Fletcher study, however, firmly believed that solutions could be found and that emerging technologies would support a survivable defensive system.

I believe that a combination of component hardening, maneuvering, active countermeasures, and the intelligent selection of orbits and constellations will enable a defensive system to remain effective—even in the face of dedicated attack.

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## QUESTIONS SUBMITTED BY SENATOR SAM NUNN

### ALLIED AND SOVIET PARTICIPATION IN SDI

Senator NUNN. Mr. Ikle, some administration spokesmen, perhaps even yourself, have suggested the possibility that the development of these sophisticated missile defenses could be a cooperative undertaking, either with your NATO allies, or even with the Soviet Union. Would you describe the administration's plan to involve our European allies substantively in this development? How much of the $26 billion 5-year development cost might we expect them to shoulder? And what overtures does the administration plan toward the Soviet Government?

Mr. IKLE. A number of our allies have shown an interest in working with us to develop effective technologies against ballistic missiles. However, in the short span of time since the President made his decision to pursue the research program which was recently presented to Congress, there has been insufficient opportunity to fully define the nature of allied participation.

In our conversations with the Soviets on this matter, we have been defining what it is we plan to do under the SDI research program and what our purpose is in conducting such research. It is our hope that later, when they appreciate the seriousness of the SDI and understand that propaganda efforts designed to undermine national support for the program are unlikely to succeed, they will be prepared to enter into serious, two-way discussions on the development of defensive technologies and the future of defensive systems.

### SOVIET VIOLATION OF THE ABM TREATY

Senator NUNN. Mr. Ikle, the administration has now declared that the large phased-array near Kransoyrrsk "almost certainly" violates the ABM Treaty.

Given this, what does the administration propose to do about Soviet noncompliance?

Does the administration plan to declare the ABM Treaty null and void?

What are our options?

Mr. IKLE. The Reagan administration is now studying potential responses to Soviet arms control violations. While no conclusions have been reached as yet, it should be noted that the United States is continuing to carry out its treaty obligations and commitments.

There are no easy answers to the problems posed by Soviet arms control violations. The administration understands that any effective response to Soviet noncompliance will require congressional support. Proposals for serious responses by the administration, if rejected by the Congress, would have disastrous effects upon our ability to terminate Soviet non-compliance. As the President said in his letter to the Congress of January 23, 1984, "The executive and legislative branches of our Government have long had a shared interest in supporting the arms control process. Finding effective ways to ensure compliance is central to that process. I look forward to continued close cooperation with the Congress as we seek to move forward in negotiating genuine and enduring arms control agreements."

### STRATEGIC DEFENSE INITIATIVE

Senator NUNN. Dr. DeLauer, in Dr. Fletcher's statement, he says "We were not asked for, nor did we recommend, resources for assuring readiness for responding to a Soviet ABM breakout. Such needs . . . would require separate funding."

Does this mean the technology proposal before us has eliminated anything in the way of developing ABM capabilities that we might begin to field relatively quickly if the Soviets were to breakout?

What exactly in the area of near-term capabilities have you preserved or enhanced in this technology program?

Or do we have to put up still more money if we want short-term hedges, too?

Dr. DELAUER. The program, as requested in the budget request, has only eliminated near-term options for a nuclear-warhead-armed terminal defense interceptor missile. However, other options for near-term defenses of the U.S. and our Allies are integral parts of the SDI program. These options have been formulated such that these non-nuclear defenses could be deployed within one to three years of the earliest time that we could deploy nuclear armed defenses.

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## QUESTIONS SUBMITTED BY SENATOR JEFF BINGAMAN

### STRATEGIC DEFENSE INITIATIVE

Senator BINGAMAN. Dr. Lowell Wood of Lawrence Livermore Laboratory told an audience at the American Legion Press Club on December 1, 1983, that "As a specific example of what serious people have said they believe could be done, a beam-weapons system which would defend the United States, which will bust Soviet ballistic-missile attacks launched through submarines and which would likewise defend Western Europe and Japan from an SS–20 type of attack, was posed to the government as a feasible option by responsible people at the national laboratories and in the military-aerospace industry, with a five-year time from the present to initial operational capability of the system, and a eight-year time from the present to full operational capability of the system, at a total system cost of $10 billion . . . The system which I suggested, which I believe could be created in eight years, is an incomplete one, a first step. It is the sort of logical first step I believe that one might look toward as far as providing strategic defense for this country and for its allies in Western Europe and East Asia . . . it is the sort of thing which, if both countries, the U.S. and the U.S.S.R., deployed it, would roll back the super-short time scales that presently prevail."

Could you comment on the feasibility of such a partial defense system as a first step in the time period Dr. Wood advocates? What technology is involved in Dr. Wood's system? What are the key technical uncertainties? Why was this suggestion rejected by the Fletcher Commission and the Defense Department?

Dr. DELAUER. The partial defense system, which Dr. Wood was presumably referring to, is the so-called "pop-up X-ray laser" concept. This concept envisions X-ray laser beams generated by a device which uses a nuclear-explosive power source. These X-ray lasers would conceptually be placed on-board ground- or sea-based missiles which would "pop" them up out of the atmosphere to destroy attacking boosters once an attack has been detected.

The X-ray laser concept is based on several new areas of physics. The ability to generate X-ray laser beams of the brightness and "divergence" (i.e. range) necessary for an effective and affordable defensive system is unknown. Uncertainty also exists in the systems that would be required to acquire and point X-ray lasers, the lethality of these lasers against boosters and warheads, the ease with which countermeasures could be developed, and many other aspects of a working system.

The Defensive Technologies Study ("Fletcher Study") and the SDI program have not rejected the X-ray laser concept. The Fletcher Study concluded that we did not know enough about *any* advanced ballistic missile defense concept to make full-scale development decisions at this time. The SDI has been formulated to fully assess the uncertainties in the X-ray laser concept among many other concepts. Based on the success or failure of possible SDI research on the X-ray concept and comparisons with other concepts, we believe that informed decisions on full-scale development of effective and affordable systems can be made in the early 1990's.

### HIGH FRONTIER

Senator BINGAMAN. Lt. General Daniel Graham has been advocating the deployment of a space based anti-ballistic missile system on a crash basis for the past two years. Could each of you comment on why this suggestion was rejected by the Fletcher Commission and the Defense Department?

Dr. DELAUER. The Fletcher Commission did not reject the principal concept advocated by the High Frontier to use kinetic energy weapons for defense of space assets and destroying attacking ballistic missiles. In fact, the Commission concluded the concept was fundamentally sound but some of the embedded technologies required additional refinements before committing to a specific space defense concept.

STRATEGIC DEFENSE INITIATIVE

Senator BINGAMAN. Aviation Week has reported the testing of an explosively driven iodine pulsed laser at Sary Shagan in the Soviet Union. What is the potential of this technology both as an ASAT and for ballistic missile defense? Are we pursuing this technology in our strategic defense initiative or in our ASAT program? How soon will we be at the stage the Soviets have apparently already reached with this technology?

Dr. DELAUER. U.S. work in explosively driven iodine pulsed lasers has been primarily limited to basic research. The purpose of this research is to investigate the physics of the pumping mechanism, energy transfer, kinetics, energy extraction, and beam quality. A one kilojoule device has been tested with relatively low energy conversation efficiency. The Defensive Technologies Study Team (Fletcher panel) assessed this concept to be much less technically advanced than other directed energy concepts.

Senator GOLDWATER. The meeting stands adjourned.

[Whereupon, at 12:45 p.m., the committee adjourned, subject to the call of the Chair.]

# DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1985

THURSDAY, MARCH 22, 1984

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC AND
THEATER NUCLEAR FORCES,
COMMITTEE ON ARMED SERVICES,
*Washington, DC.*

## STRATEGIC DEFENSE INITIATIVE

The subcommittee met in executive session, pursuant to notice, at 9:20 a.m., in room SR-222, Russell Senate Office Building, Senator John W. Warner (chairman), presiding.

Present: Senators Warner, Thurmond, Wilson, Exon, Levin, and Bingaman.

Staff present: Robert F. Bott, William E. Hoehn, Jr., George K. Johnson, Jr., and James C. Smith III, professional staff members; Arnold L. Punaro, staff director for the minority, and Brenda K. Hudson, assistant chief clerk; Judith A. Freedman and Douglas R. Graham, research assistants; and Karen A. Love, staff assistant.

Also present: Gerald J. Smith, assistant to Senator Goldwater; Les Brownlee, assistant to Senator Warner; Robert Savitt, assistant to Senator Cohen; Bernard R. Toon, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson; Francis J. Sullivan, assistant to Senator Stennis; Jeffrey B. Subko, assistant to Senator Exon, and Edward McGaffigan, Jr., assistant to Senator Bingaman.

### OPENING STATEMENT BY SENATOR JOHN W. WARNER, CHAIRMAN

Senator WARNER. Good morning, gentlemen.

The subcommittee convenes this morning to continue to receive testimony on the Strategic Defense Initiative in review of S. 2414, the fiscal year 1985 defense authorization bill.

On behalf of the subcommittee, I would like to welcome Dr. Robert Cooper, Director of the Defense Advanced Research Projects Agency. Dr. Cooper is accompanied by John L. Gardner, Director of Defensive Systems and Brig. Gen. Robert Rankine, Assistant for Directed Energy Weapons, both with the Office of the Under Secretary of Defense for Research and Engineering; and Franklin Miller, Director of Strategic Forces Policy with the Office of the Assistant Secretary of Defense for International Security Policy.

I might add that our witnesses participated in various capacities on last summer's Defensive Technologies Study Team.

The full Armed Services Committee conducted an initial hearing on the Strategic Defense Initiative on March 8, 1984. At that time, Dr.

Richard DeLauer and Dr. Fred Ikle provided the committee with a very informative overview of the technology and policy issues associated with this important new initiative.

Today, the subcommittee meets in executive session to explore this program on a more detailed level. This hearing—together with the earlier full committee hearing and the intelligence assessments of Soviet military space capabilities received by this subcommittee on several occasions—will establish the basis on which we justify our recommendations on the President's Strategic Defense Initiative.

Although we are in executive session, it is represented to the Chair that the Department of Defense will make available in a short time a sanitized version of the hearing.

You may proceed as you wish. Have you decided among yourselves the order of your presentation?

## STATEMENT OF DR. ROBERT COOPER, DIRECTOR OF ADVANCED RESEARCH PROJECTS AGENCY

Dr. COOPER. Mr. Chairman, we are really very happy to be here today to follow up on our previous testimony of March 8 before the full committee to give you more of the details of the Strategic Defense Initiative that the President has launched this past year.

We have this morning a representative from the Under Secretary of Defense for Policy's Office, Mr. Franklin Miller, who will lead off by giving a general description of some of the policy issues associated with strategic defense and then Brig. Gen. Robert Rankine, who is the Assistant for Director Energy Weapons in the Under Secretary for Research and Engineering Office, to give you details about where the spending will be in the program for the fiscal year 1985 budget.

Dr. John Gardner, on my far right, who is Dr. DeLauer's Strategic Defense Director, will also give you some details associated with the program.

So, if you agree, we will start now by having Frank discuss the policy issue.

Senator WARNER. Before starting, I understand that we have received this morning a declassified copy of the Fletcher Commission Report; is that correct?

Dr. COOPER. That is correct.

Senator WARNER. The report "The Strategic Defense Initiative," defensive technologies study, dated March 1984, will be inserted as an appendix to this hearing. [See app. A, p. 2992.]

Mr. Miller, please proceed.

## STATEMENT OF FRANKLIN C. MILLER, DIRECTOR, STRATEGIC FORCES POLICY, OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE FOR INTERNATIONAL SECURITY POLICY

Mr. MILLER. Senator, in my job as Strategic Forces Policy Director, I focus on both offensive and defensive strategic systems, but clearly for the past year the role that the defensive systems play in our national strategy has been increased.

You will recall that the President's speech on March 23, 1983, issued a challenge to both the Government and to the scientific community to eliminate the threat of ballistic missiles—ballistic missiles of

both tactical and intercontinental ranges—that would threaten both the United States and our allies.

Following the President's speech, two major studies were undertaken last summer.

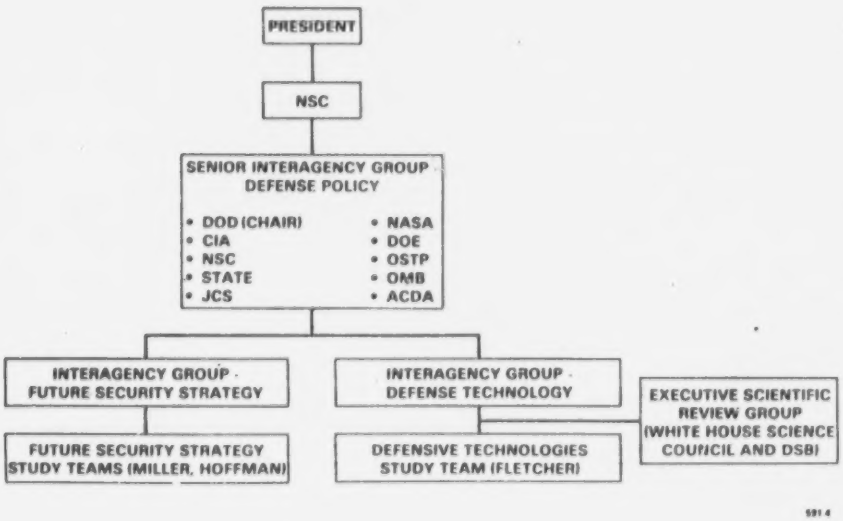
The first was a technology study, the Fletcher study, which asked the question: Can we in fact develop effective defenses against ballistic missiles?

The second, the Hoffman study, asked if we could do that, how would this affect the security of the United States and of our allies?

Based on those two reports, which we will summarize for you this morning, the interagency community reported to the President in October 1983 that there was both promise and uncertainty in the area of advanced ballistic missile defenses and that a research program was needed to resolve those uncertainties.

In January the President issued [deleted] which defined the SDI program and helped shape the fiscal year 1985 budget request now before the Congress. The program and its supporting budget are designed to refocus and reorganize our entire research effort in order that we might be able to answer the questions necessary to an informed decision in the future on full-scale engineering development and on deployment of these systems.

**ORGANIZATION FOR NSSD 6-83**




This slide gives you some idea of the breadth and depth of the Government's study. Virtually the entire national security community was involved in this effort over the past summer, including representatives from NASA, Department of Energy, OMB, and the Arms Control and Disarmament Agency as well as the Joint Chiefs of Staff and the military services.

The future security strategy study consisted of two parts. I directed the Pentagon's interagency policy study.

There was an independent policy effort led by Mr. Fred Hoffman which contributed to the future security strategy study.

The interagency group defense policy had as its executive secretary Brig. Gen. Bob Rankine and the Fletcher group executive secretary was John Gardner.

So, you have before you today the three people who were really involved in helping to run this effort below the Under Secretary level.

We will give to the committee this afternoon an unclassified version summarizing both the technology and the policy reports.

As I said, the basic thrust of both studies was that there is promise and uncertainty in the area of advanced ballistic missile defenses. I would like to turn to some of those areas now.

Senator WARNER. I am going to interrupt. I want to get clear in my mind the documentation before us.

Mr. MILLER. You have three documents.

The one in your hand, Senator, is a detailed unclassified version of the Fletcher study, which speaks to the technology issues.

We will give to you this afternoon an unclassified version of the Hoffman report. That is the effort that examined policy issues and which made a contribution to the overall deliberations.

The third document is a combined policy-technology report which summarizes the overall interagency group conclusions, which went to the President.

Senator WARNER. Then the committee, of course, has all of the classified material. We received that some time ago; is that correct?

Senator BINGAMAN. Mr. Chairman, do we have the classified version of the Hoffman report?

I have never seen that. Is that something we can get?

Mr. MILLER. I am sure we can make that available.

Senator BINGAMAN. For the committee's use, I mean.

Senator WARNER. The request is hereby lodged for that.

Will there likewise be a classified version of item 3, the combined technology and policy report?

Mr. MILLER. That is an executive document, I believe, Senator.

Senator WARNER. You are giving us the unclassified part, but declaring that the classified part of item 3 is an executive document?

Mr. MILLER. I don't have the authority to say that. I will have to take that question back.

Senator WARNER. Will you clarify that, please?

Mr. MILLER. Yes, sir.

[OGC has ruled it to be an executive document not subject to release.]

POLICY IMPLICATIONS

Hedge against Soviet program.
Implications for deterrence.
Implications for current U.S. programs and force policy.
Implications for arms control.
Implications for foreign policy.

Mr. MILLER. What I would like to review are the areas covered by the interagency policy report.

This committee has already been briefed on Soviet efforts in both traditional ABM systems and on Soviet research and development on advanced ballistic missile defenses.

Reviewing this quickly, the Soviet Union today does support the world's only traditional ABM system, the Moscow system. They are upgrading that system with new radars and interceptor missiles.

If there are any questions, we have a representative from DIA with us this morning.

The Soviets are pursuing research and development on an ABM system which could be rapidly deployed. There are warm production lines for interceptor missiles and for a radar which could be used to help provide ballistic missile tracking information.

The Soviets also are pursuing advanced ballistic defense technology, such as lasers and particle beams.

The interagency study concluded that a U.S. defensive technology research program would constitute a very prudent hedge against the Soviet program regardless of any decision in the future to go to full-scale development or deployment, that a research program in and of itself not only provides answers to the uncertainties we talked about earlier and we discussed in some detail, but that it also provides a hedge against Soviet activities in this regard.

Senator BINGAMAN. Mr. Chairman, could I ask the Chair——

Senator WARNER. Members are free to ask questions.

Senator BINGAMAN. One of the issues we got into the other day at the hearing with Mr. Perle and the CIA was the extent of the Soviet capabilities. I don't know if that is an appropriate issue to get into with these witnesses or if we will have additional hearings.

Senator WARNER. I would suggest you go ahead and pose the question.

Senator BINGAMAN. At some stage here I would like to get your views as to the accuracy of the information we received the other day about Soviet capabilities, particularly in the laser advanced defense technologies.

We got such information, as I recall it, and we have the transcript, I am sure, that they have the capability [deleted].

That was my understanding.

Senator WARNER. The testimony was in the context of the hearing on ASAT and the witnesses indicated that there was an [deleted].

I believe that is what the Senator is referring to.

Senator BINGAMAN. Yes. Basically they were describing the Soviet capability which I had not understood as we thought they had.

I am not trying to detour your testimony into an aside area at all, but I would like at some stage to get a reaction and understanding if that is the position of the administration as to what they can do.

Mr. MILLER. Would you like to pursue that now for a moment?

Dr. COOPER. Senator Bingaman, we are going to be talking about aspects of the program which have to do with major systems' survivability which is a technical effort in the defense program. Perhaps it would be better to come back to that question after we have looked at the issue of survivability in our research program and try to address sort of where we stand with respect to the Soviets in the context of that discussion.

Senator BINGAMAN. That would be fine with me. I would like to get a response.

[Additional information follows:]

STRATEGIC DEFENSE INITIATIVE

Our intelligence information gives us a good feel for the "inputs" to the Soviet program; we have firm indications that they are expending far more effort than we are on technologies for advanced ballistic missile defense. This is especially true in the field of directed energy weapons. In this field they have conducted a number of major technology demonstrations and others are in progress. On the other hand, our intelligence information gives us little measure of the Soviets' "outputs," i.e., the specific performance characteristics actually achieved and demonstrated in their experiments and major technology demonstrations. We can only judge their progress by noting how hard they appear to be working the problems, and then assuming that they make a reasonable rate of progress.

Senator WARNER. At this point in the record, these antisatellite weapons being developed by the Soviets now have some capability [deleted].

Dr. COOPER. That is correct. The issue is: What is your opinion or interpretation of what that capability is and how it may relate to the programs that we have underway in the strategic defense area, and perhaps it would be better to look at this issue and this question in relationship to our programs which will be covered in the next briefing.

Senator WARNER. Have we properly framed the Senator's important question so that you have it in mind?

Dr. COOPER. Yes, indeed.

Senator BINGAMAN. That is fine, just so at some stage we are sure that we get an agreement, if there is one, as to what the Soviets can or cannot do.

Senator LEVIN. Mr. Chairman, how long will this presentation be and when will they reach that point?

Dr. COOPER. It is in the next briefing. Frank will probably be finished in 10 or 20 minutes. It is the heart of the next briefing.

Senator WARNER. Will that meet the Senator's schedule?

Senator LEVIN. I was suggesting if it was a long way off, we might get to this particular matter of interest.

Mr. MILLER. One question which we did examine in some detail in the interagency study is whether the deployment of advanced ballistic missile defenses would cause any change in the longstanding U.S. policy of deterrence.

We concluded that the answer was no, that up until the late 1960's U.S. deterrent policy always included a mix of offensive and defensive systems. It wasn't until the late 1960's, when we began to dismantle the U.S. air defense system, that we shifted to the current posture, which is one of almost exclusive reliance on offensive retaliation.

The first point was that deploying advanced ballistic missile defenses in the future would not in and of itself cause any change in the policy of deterrence.

Senator BINGAMAN. Let me nail this down, if I could.

I grant you we still have a policy of deterrence.

Are you suggesting that pursuing the defensive side of our capability is not a change in policy? Is that your point?

Mr. MILLER. I am saying that the overall thrust, Senator, which is to deter, would not be changed.

Senator BINGAMAN. I can see that argument, but clearly we have never put the kind of major effort into developing a defensive capability that is now being proposed by the administration.

Mr. MILLER. In the 1950's and 1960's we did have a fairly extensive defensive component in the strategic area, with the surface-to-air missiles all over the country and its large interceptors.

We never had a defense against ballistic missiles. As the ballistic missile threat came on, Secretary McNamara decided we could not defend effectively against that and that therefore, we should reduce the air defense establishment to its current level.

Throughout the fifties and most of the sixties we had a very large air defense establishment.

Senator BINGAMAN. Thank you.

Mr. MILLER. If we were in fact able to develop effective defenses against ballistic missiles, this would have the potential of increasing deterrence and stability in three major ways.

The first is that any Soviet planner facing an effective ballistic missile defense system would realize that the probability of his making a successful attack would be decreased substantially.

The second is if we were in fact able to block all or a large portion of his fast flying systems, the systems that he could use effectively for a surprise attack, then we would have in fact blocked his ability to carry out a preemptive attack.

This is important especially in the context of Europe because currently the Soviets are moving increasingly toward reliance on offensive ballistic missiles of all ranges with conventional warheads to strike throughout the depth of the NATO theater in a rapid coordinated manner.

If you take that away from the Soviet planner, he cannot carry out those strikes throughout the depth of the theater with such precision and such speed.

Therefore, deterrence against conventional aggression, as well as nuclear aggression, could be enhanced.

Finally when combined with effective air defenses, especially in Europe, effective ballistic missile defense could eliminate counterforce attack options.

To fulfill these promises, there are two major areas to be addressed. These are the uncertainties that I spoke to earlier.

First, a defensive system not only has to be effective, but it has to be survivable. If we cannot develop a survivable defense against ballistic missiles, if we are moving down the road to a system that appears itself to be subject to rapid attack, we clearly would not have aided the cause of stability or deterrence at all.

That is an important area that the research program is looking at.

The second point harkens back to the ABM debate of the late sixties. That is, can we develop a defensive system which costs the offense much more to overcome than the cost to field and maintain a defensive system?

That is another area of tradeoff between offense and defense that is being looked at.

Senator LEVIN. What about consistency with the arms control agreement?

Mr. MILLER. I will come to that Senator.

We looked at the question of whether in the near term the research program would require or allow any decrease in the current emphasis on offensive retaliatory programs such as the Peacekeeper, the small ICBM, the B–1, the ATB, Trident II, Pershing II, or the cruise missile programs.

The fact remains that what we are talking about is a research program, and a research program does not provide deterrence. If in fact we were to make a decision with the Congress and our allies in the early 1990's to proceed with full-scale engineering, development, and deployment of the system, even then we would have to maintain deterrence through the transition period from an offense only deterrent to one involving a mix of offensive and defensive systems.

Projects currently underway will provide necessary deterrents throughout the research program and whatever period we enter into after the research program is completed.

So, our emphasis on the modernization of strategic and theater nuclear forces remain a top priority.

Senator BINGAMAN. Mr. Chairman, you are talking about the transition period. If this were developed, then there would be a transition period which would transition us to a defensive system or transition us to both a defensive system and an offensive system?

Mr. MILLER. Our current thinking is that there will still be a role for offensive systems in our overall deterrent. That in part is because of our strategy in Europe, which does entail reliance on flexible response, on offensive retaliation with nuclear weapons as a counter to massive Soviet conventional attack.

So, one has to continue to deter the tank army attack as well as the ballistic missiles attack.

Senator BINGAMAN. You say we will need offensive strategic weapons in order to deter conventional attack?

Mr. MILLER. We will need offensive weapons, both nuclear and conventional, to continue to deter attack by Soviet conventional weapons and by Soviet nuclear weapons.

The systems we are talking about here will provide advanced ballistic missile defense.

The Soviets would still have cruise missiles, nuclear artillery, and aircraft capable of delivering nuclear weapons. They would still possess their significant tank armies designed for offensive operations.

NATO itself would need some capability to escalate the conflict if our conventional defenses were faced with defeat.

That raises other questions that I am not prepared to go into at this time, questions I know the committee has discussed and Senator Nunn is particularly interested in and that is the area of using advanced and emerging technologies to provide a conventional-only defense in Europe.

As we currently rely on some threat of escalation to deter Soviet tank armies, we would still have to continue to deter such attacks even if we could stop Soviet ballistic missiles.

If the Soviets develop, and there is indication they are working on developing, advanced ballistic missile defenses of their own, NATO's offensive retaliation would have to be carried by aircraft or cruise missiles, presumably with the application of [deleted] technology.

Senator LEVIN. You mentioned cruise missiles, intermediate range missiles.

Does the SDI include a potential defense against those or not?

Mr. MILLER. Not cruise missiles, although there are SDI technologies that could be applicable especially in the sensor area. SDI looked at both the technology and the policy side on stopping Soviet intercontinental ballistic missiles, as well as shorter range systems such as the SS–20, SS–21, SS–22, and SS–23.

There is particular application to the European theater. If you can take away the conventional armed versions—as well as their nuclear counterparts—of the SS–20, SS–21, SS–22, SS–23, which pose a threat of a massive strike throughout the NATO rear in a short period of time, then you will have taken away the very direction in which the Soviet offensive theater forces are evolving.

You asked about arms control, Senator Levin. The research and development in the program that is before the Congress is fully consistent with all U.S. treaty obligations. That includes the ABM Treaty, Outer Space Treaty, and Limited Test Ban Treaty.

During the summer we also looked at the question of future arms control regimes and how we might use arms control to ease the transition period when both the United States and the Soviet Union might move from the current reliance on offensive systems to one involving more of a mix of offensive and defensive systems.

Senator LEVIN. You are not saying, though, that you are not going to propose the development of a system which doesn't violate those treaties?

Mr. MILLER. Clearly if the decision were made in the nineties to go ahead with full scale engineering development and deployment of advanced ballistic missile systems, it would bump up against the ABM Treaty.

Senator LEVIN. You say the R&D itself does not?

Mr. MILLER. The R&D program we are talking about today and which would be necessary for an informed decision in the early 1990's is fully consistent with treaty obligations.

Senator WARNER. Suppose we decide on a single system, as the Soviets are doing in Moscow?

Mr. MILLER. A single system within the constraints of the ABM treaty, 100 launchers at a particular place, if they were traditional ground-based interceptors, they would be fully consistent with the treaty.

Senator WARNER. You are saying this R&D is going to lead to technologies over and above the ABM treaty?

Mr. MILLER. If we went to full-scale engineering development and deployment.

Senator WARNER. Of the systems now in consideration?

Mr. MILLER. Some of the systems now in consideration.

Dr. COOPER. Absolutely.

It should also be said that the technology of the more conventional ABM systems which are included under the treaty will also be advanced by this strategic defense initiative.

We would have the option of deploying systems that would be fully in compliance with the ABM treaty if that was felt to be desirable.

Senator WARNER. Could that system embrace all the technologies that presumably will be developed?

Dr. COOPER. Probably it could not.

Senator WARNER. So, there are two limitations.

First, a single system, and second, certain types of technologies under the ABM treaty and it is likely if we want to go into a deployment mode, we would want to go into more than one system, and we would incorporate technologies which are capped at the present time by the treaty.

That is a rough generalization.

Dr. COOPER. That is right.

The third aspect of that is the potential for this technology to be the underpinning for an antitactical ballistic missile system that could be deployed with our forces in Europe.

That also is a potential outcome that is not covered in the ABM treaty.

Mr. MILLER. Anti-tactical ballistic missiles would be consistent with the ABM treaty. That is the position of this Government as stated in 1972 during hearings on the ABM treaty.

The Soviet system, SA–X–12, [deleted] is an air defense system which has antitactical ballistic missile capability. There is nothing in its development which contravenes the ABM treaty because that treaty deals with strategic antiballistic missile systems.

Senator WARNER. My understanding is that we heard the SA–X–12 has a potential for use against reentry vehicles.

Can you expand on your statement?

Mr. MILLER. [Deleted.]

It may have a potential, according to the intelligence community, to be used against some strategic ballistic missile warheads, [deleted].

Senator WARNER. So far as we know, or would we know?

Dr. Sellers?

Dr. SELLERS. [Deleted.]

Senator LEVIN. Is your answer to the ABM treaty the same as the outer space treaty?

Are we researching systems that would also violate the outer space treaty if deployed, full-scale development?

Mr. MILLER. The outer space treaty prohibits the stationing of nuclear weapons in space.

[Deleted.]

Dr. COOPER. It should be pointed out that that technology, if pursued vigorously, does not necessarily imply the necessity for positioning those weapons in space.

If such a weapon system were developed in the future, there are other methods of employment that would be completely consistent with the outer space treaty.

Senator WARNER. Is there a difference of viewpoint between the two of you on this?

I notice Dr. Cooper started off and then Mr. Miller corrected him.

Are you with one position on that question?

Dr. COOPER. On the issue of [deleted] some sort of conflict with the outer space treaty? Is that the question?

Senator WARNER. When we started off, you began to testify and then your colleagues interrupted. I just want to make sure there is agreement.

Dr. COOPER. I don't believe there is any disagreement between us on these issues.

Senator WARNER. Thank you.

Mr. MILLER. Two things that one would want arms control to do in a future transition period would be to manage that transition and make it more predictable.

One would also like it to help prevent the development of technologies which would threaten the survivability of ballistic missile defenses.

Senator BINGAMAN. Why would the Soviets have any incentive to enter into arms control to accomplish that kind of transition?

Mr. MILLER. The world would clearly be more stable.

Senator BINGAMAN. The world would be more stable once we transferred to this system?

Mr. MILLER. Let me take you back two steps.

The first step is that if both sides have effective defenses against ballistic missiles, that means both sides are protected from attack by very fast-flying systems. These systems, ICBM's and SLBM's, are universally acknowledged to be the most destabilizing aspect of the strategic relationship, because their fast flight times pose a greater threat to stability than bombers.

If both sides were able to defend themselves against attack by fast-flying systems, there would, by definition, be more stability. Attacks could not occur except over a period of hours, not over a period of minutes.

That is the first point.

A world in which both sides have survivable defenses would be more stable. The Soviets have recognized that.

Second, whether the Soviets choose to cooperate with the United States in the development and deployment of advanced ballistic missile defenses or not is an unknown.

Clearly they are working in that area, but the Soviet policy response to future arms control in this area is something that can't be predicted at this time.

We looked at Soviet defenses. Clearly there are some incentives and there are some areas where there are no incentives. If they believe the United States is abandoning this area of technology while they are working on advanced systems themselves, why would they enter into arms control agreements?

That is not clear. I would not want to make any prediction.

What I did want to say is that arms control could make a transition easier and it could make the systems more survivable by preventing the development of technologies which would threaten their survivability.

What we concluded during the summer is that it was premature at this point to draw up arms control agreements of that type because we don't know what a United States or Soviet system would look like.

If the U.S. system were built over a 10-year period and deployed in stages over that 10-year period and the Soviet system was produced over a 9-year period, but only deployed in that last year of the decade, clearly it would be very difficult to construct a transition regime.

We don't know what the U.S. system is going to look like, or the Soviet system. To sit down and try to fashion an arms control transition regime at this time would be a paper exercise and an exercise in futility. It would not be a real world exercise.

Until we know more about the survivability of these platforms and survivability of techniques which John Gardner and General Rankine will discuss, it is hard to say how a treaty to enhance survivability would most appropriately be framed.

We have concluded at this point that we cannot come up with any panaceas or a projected treaty. We will be watching especially closely as the research and scientific advice comes in to us.

Finally, there is the question of foreign policy. John Gardner and I led a team which briefed this in Europe [deleted].

[Deleted.]

General Rankine and Mr. Bill Furniss of my staff led a team that went to the Pacific: [deleted].

We consulted fully with the foreign ministries, the defense ministries and cabinet officials in all countries.

Senator WARNER. What was the time of these consultations?

Mr. MILLER. That was the first 2 weeks in February, Senator.

Senator WARNER. 1984?

Mr. MILLER. Yes. I should say that Secretary Weinberger has written three letters, three long letters, to his NATO colleagues in this area and the subject has been the topic for discussion among minsters at NATO nuclear planning group ministerials and defense planning committee ministerials, and for NATO foreign ministers last December at the North Atlantic Council.

There has been a great deal of discussion among the NATO allies. It is usually a topic on any bilateral meeting between NATO ministers of defense and Secretary Weinberger. We have talked fully with the allies.

The message we wanted to leave in Europe during our February trip had three parts.

The first was, contrary to some popular conceptions, the SDI was not an attempt to create a fortress America. We were looking at ballistic missile defenses which would cover missiles of all ranges, including all of those that threaten Europe.

The second was that the Soviets do have a very active research program—indeed on the traditional ABM side, a production program—and that the area of advanced ballistic missile defense is not an area in which western actions will necessarily govern the outcome overall.

There are, in fact today, Soviet activities in the area.

The third point we wanted to make is that this is a research program. We are talking about getting the answers to questions so that in the early nineties we will be able to make informed decisions with the Congress and with the allies on full-scale engineering development and deployment.

Senator WARNER. What is the reaction, generally speaking?

Mr. MILLER. The reaction was one of great interest. They took those points aboard. There was some concern about whether this would affect our ability to continue the linkage between nuclear deterrence and conventional defense.

I answered those in the way I answered Senator Levin and Senator Bingaman, relying on aircraft systems and [deleted] technology.

[Deleted.]

Senator LEVIN. Will you expand on that a bit, [deleted].

Mr. MILLER. [Deleted.]

Senator LEVIN. [Deleted.]

Mr. MILLER. [Deleted.]

They were grateful for the fact that we made the effort to come over and present exhaustive briefings at the senior and mid levels. They appreciate the fact that we will consult with them closely on this in the future.

[Deleted.] President Mitterrand spoke to the Dutch Parliament in The Hague advocating development of a European space system and to consider doing, among other things, ballistic missile defense.

That concludes my part of the briefing in terms of telling you what we saw to be both the potential and uncertainties in the policy area regarding these systems.

The uncertainties, we believe, are such that we needed more information from the technical community before we can make any informed decisions about these kinds of systems.

Can you make a defense system survivable? We know how that would affect deterrence and stability, but can you make it survivable? Can you deal with a short-range as well as the long-range threat? How can we construct future arms control agreements?

Those are the questions before us. We won't have any answers until more is known of the technology.

Senator WARNER. I suppose the Achilles heel in the survivability issue is the command post, so to speak, as opposed to the weapons themselves?

Mr. MILLER. If I understand correctly, there will be a separate hearing on survivability, but there are various aspects.

Senator WARNER. Go ahead.

Dr. COOPER. In partial answer to your question, Senator, the issue extends throughout any potential system that might be developed.

That is, the eyes of the system could be blinded by a direct attack. The weapons could be disabled by a direct attack or the battle management capability could be disabled by a direct attack.

So, any system that gets developed in the future will have to take all of that into account.

We are ready now to go on to General Rankine's description of our program and how that program is related to the key issues that were brought up in the Fletcher committee report.

## STATEMENT OF BRIG. GEN. ROBERT R. RANKINE, ASSISTANT FOR DIRECTED ENERGY WEAPONS, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

General RANKINE. Mr. Chairman, Mr. Miller has explained to you the strategy and policy rationale as to why we should undertake such a research program.

I want to address more specifically what the research program is.

You will recall in the President's speech of 1 year ago tomorrow he indicated that sophisticated technologies were emerging that led him to believe that we should undertake such a program. He called for a technology study.

The study was led by Dr. James Fletcher. The Fletcher study indeed concluded that there were technologies which would make a dif-

ference, that we could conceive of in the future a defensive system which would be both effective and cost effective.

NEW TECHNOLOGIES THAT MAKE AN EFFECTIVE DEFENSE FEASIBLE

Directed energy technology: Visible and IR lasers, and neutral particle beams.
Precision sensors: Two-dimensional (MOSAIC) optics for search and tracking, laser imaging (LIDAR), and millimeter wave radar imaging and tracking.
Electronics advantages: "GIG OP" processors, micro-miniaturized electronics, and combination with precision sensors make small precision-guided hit-to-kill interceptors possible.
Hypervelocity gun technology.

The technologies that the Fletcher Commission illuminated particularly are the ones shown on this chart: Specifically directed energy technology which would enable us to, for the first time, perhaps attack boosters during the boost phase and during the post-boost phase, which gives tremendous leverage to the defense because now a single shot from a defensive weapon would be able to disable several MIRV'd warheads and several decoys with a single shot.

In addition to that, the use of precision sensors on midcourse interceptors, coupled with the ability to do discrimination with laser energy so that we can separate out true warheads from decoys, would enable us in the midcourse intercept phase to have defenses which were more cost effective than the offenses.

Finally, the ability to do billions of operations per second would enable us to control and manage and provide the battle management for a multitiered system in the time period that such a system might be possible.

Those technologies coupled with advanced technologies such as hyper velocity guns, which would fire projectiles at very high velocities, represent a set of new technologies that weren't available 15 years ago when the United States had launched a major investigation into the potentialities of defenses.

FLETCHER STUDY CONCLUSIONS

Powerful new technologies are becoming available that justify a major technology development effort to provide future technical options for defense against nuclear ballistic missiles:
Pace: Now, broad-based, focused technology development. Early 1990s—Option to proceed is available.
Features: Multiple layers, technical demonstrations, survivability, and innovation.

Based upon their evaluation, upon the technical evaluation of the promise of ballistic missile defense, the Fletcher study concluded that "powerful new technologies are becoming available that justify a major technology development effort to provide future technical options for defense against ballistic missiles."

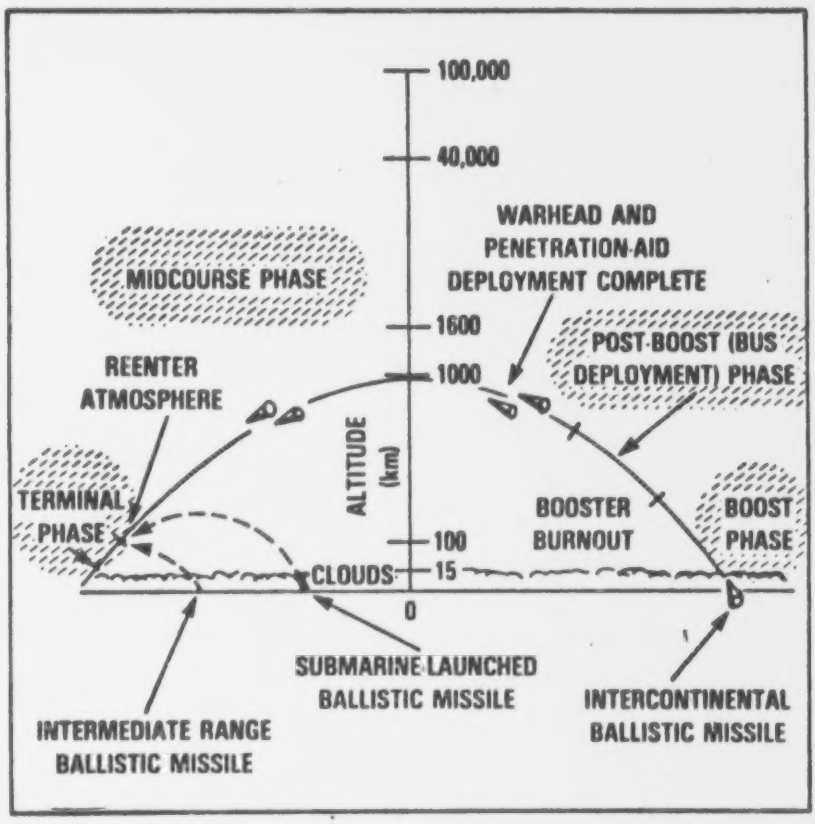
That is a quote from the Fletcher study report.

Dr. Fletcher's recommendation was that we should begin the program now and if we began a program now which was broad based, technologies that appear promising, and focus specifically those technologies on ballistic missile defense, if we undertook such a research program now, future Presidents, future Congresses in the early nineties could be in a position to make a decision on whether or not to proceed into full-scale systems development.

The program that Dr. Fletcher recommended, that the Department of Defense and the Government undertook, has features that are illustrated here.

First of all, he envisioned the system needed to be multilayered. I will explain that in more detail in the next chart.

MULTIPLE LAYERED DEFENSE




For two primary reasons:

First of all, in an engineering sense, if we have a multilayered system, then no particular layer of the system has to be absolutely perfect or try to achieve an extremely high level of effectiveness, but rather taken as a set, the system as a whole gives us a great deal of confidence that we can intercept ballistic missiles.

It is similar to the fleet defenses the Navy uses with F–14's, and so forth, and finally ending up with interceptor missiles and guns.

That defense in depth is the same type in principle that we wish to apply to ballistic missile defense.

Another reason why that is a preferable approach to a single layer is that it has the ability to overcome countermeasures, the ability of your opponent to countermeasure four different layers, each of which uses different weapons and different sensor phenomenology is extremely difficult.

For those reasons Dr. Fletcher perceived that the most effective system would be multilayered.

He felt technical demonstrations would be necessary during this research program, not only to demonstrate to us in an engineering sense that we were making the technical progress necessary, but also to demonstrate milestones to the Congress, to the public and indeed, to the Soviets, that the United States was continuing its purpose and resolve in pursuing the program.

Survivability has already been brought up this morning, Mr. Chairman. Dr. Fletcher had the same perception that many of you have expressed. Survivability is absolutely key to the system. It will not in fact provide stable deterrence if the elements of the system are not highly survivable.

In a few moments we are going to go into the details of what the survivability program is and we are planning to specifically follow up the hearing with Mr. Perle, the principal witness.

We are planning a specific hearing with a great deal of testimony to address that issue specifically. We are prepared today to describe the survivability measures we are undertaking in research and we will, of course, answer any questions you would like to clear up in a more immediate manner.

Finally, innovation. We believe and Dr. Fletcher believes that there are many new technologies and there are many brilliant scientists in the colleges and universities and the research organizations throughout the United States and they ought to be encouraged to bring forward new innovative concepts and we should be open minded looking at those concepts and set aside a certain amount of money to foster those innovative ideas because they might even offer higher leverage defensive capability than those we were already able to envision.

Senator WARNER. A question here.

Now, are these charts marked secret because some parts are classified and others are not?

General RANKINE. Yes, sir, Mr. Chairman.

About the last 10 charts are classified secret where we go into the details of the program and start giving milestone dates.

The first 15 or 20 charts are unclassified.

Senator WARNER. I think it would be helpful in the future if we had two separate documents, one classified totally and one unclassified.

Members have so much data put before them, it would be helpful.

General RANKINE. Yes, Mr. Chairman.

Senator LEVIN. Is this now classified?

Senator WARNER. The last part, Senator.

Senator LEVIN. Up to now it is unclassified?

Senator WARNER. I would suggest that the committee staff take all of these back and make two separate documents.

Senator LEVIN. That would be helpful.

Senator WARNER. I will request the counsel of the committee to inform the Department of Defense that we would like to have separate documents.

Mr. MILLER. Some of the comments I made and all of my Viewgraphs are unclassified.

Senator WARNER. They could relate to the material that is in this report which is section 1?

Mr. MILLER. That is the technology. The policy charts reflect the words in the unclassified policy document which will be given to you this afternoon.

Senator WARNER. This is solely technology?

Mr. MILLER. Yes, sir.

Senator WARNER. There is an unclassified combined technical report which is item 3?

Mr. MILLER. Yes, sir.

Senator WARNER. Will that have the remarks you made this morning incorporated in it?

Mr. MILLER. The broad thrust of them. Some of the specific comments I made [deleted] clearly should remain out of the public record because they were classified [deleted].

Senator LEVIN. Would you supply us with a copy of President Mitterrand's remarks?

Mr. MILLER. It was at The Hague, the Dutch Parliament.

Senator LEVIN. Can you give for the record the portion of it relating to their own consideration of the space defense?

Mr. MILLER. Yes.

[The information follows:]

EXTRACT FROM THE SPEECH GIVEN BY FRENCH PRESIDENT FRANCOIS MITTERRAND TO THE GOVERNMENT OF THE NETHERLANDS IN THE HAGUE ON 7 FEBRUARY 1984

From just about everywhere, numerous voices are heard today calling for a common defense organization. The overarmament of the two superpowers, the failure of their disarmament negotiations, the tensions which result, the possession of nuclear weapons by five nations, the elimination of Europe as a force capable of autonomous plans, have raised a nostalgia and created a need the amplitude of which is impossible to underestimate. This need seems to me founded on, and the ambition which is grafted on it is an intuition for the future, but an honest examination of the question leads to the following observations: In the actual state of affairs Europe remains divided between the security which exists and the security which Europe hopes for. No one doubts that Europe would choose the first. The Atlantic Alliance is not ready to see itself replaced by a European Alliance. This results from the fact that no military force is adequate to substitute for the American arsenal. In any case, France will not use her nuclear capacity other than for her own deterrent strategy, and Europe generally will not risk finding herself uncovered. Certainly, Franco-German military relations, as a result of the Elysee Treaty, which were a dead letter on this point for over 20 years, have taken a new turning. We exchange information, we coordinate, we harmonize our approaches. The same with Great Britain, but France has not hidden from her allies that other than for the protection of her national sanctuary and the vital interests that follow, she cannot undertake the security of Europe; both for strategic reasons and for reasons of international politics resulting from World War II, the decision to use French nuclear weapons cannot be shared. Nevertheless, the field for cooperation in our own security remains vast. Not only in conventional armaments but also by the new systems that are about to burst on the world scene. One must already look beyond nuclear weapons if one does not want to miss a future which is already closer than one thinks. I will cite but one example: the conquest of space. If Europe could put into space a manned station which would permit her to observe, to communicate, and thus to thwart all potential threats, she would have gone a long way towards her own defense. Without neglecting advances in electronic calculating and artificial memory, as well as the already existing capability to fire projectiles that move at the speed of light, a European space community would be, in my view, the best adapted response to the military realities of tomorrow.

General RANKINE. Mr. Chairman, let me set the framework for the remainder of the discussions on technology and explain what I mean by multilayered or multitiered defense.

By that we mean we want to develop the capability with separate systems perhaps to attack ballistic missile in boost phase in the post-boost phase, which is the period of time when the reentry vehicles are being deployed from the bus, in the midcourse phase, long exoatmospheric situation phase and brief reentry phase.

I have shown the intercontinental ballistic missile trajectory, submarine-launched ballistic missile trajectory, and intermediate trajectory.

The figures should not be taken to mean that terminal defenses are the only things that will be effective against intermediate range ballistic missiles and submarine-launched ballistic missiles.

Indeed, the degree of effectiveness of some of the other elements is yet to be determined as we develop the technology.

Certainly the space-based aspects for surveillance, and so forth, would be applicable to any of these ballistic missile types.

## KEY TECHNOLOGY CANDIDATES

| FUNCTIONS | BOOST | POST-BOOST | MIDCOURSE | TERMINAL |
|---|---|---|---|---|
| DETECTION, ACQUISITION, DISCRIMINATION, KILL ASSESSMENT | SPACE-BASED INFRARED SENSORS | SPACE-BASED ULTRAVIOLET, VISUAL, OR RADAR IMAGING SENSORS | | AIRBORNE INFRARED OR RADAR SENSOR |
| POINTING, TRACKING | TALON GOLD | | INFRARED TERMINAL HOMING | |
| INTERCEPTION, DESTRUCTION | DIRECTED ENERGY WEAPONS, KINETIC ENERGY PROJECTILES | | NON-NUCLEAR SURFACE-TO-AIR MISSILES | |
| BATTLE MANAGEMENT | RADIATION HARDENED VHSIC, NEW SOFTWARE DEVELOPMENT TOOLS | | | |

With that framework then, it is convenient to consider what the functions are that must be performed in each of those four layers of attack, and then once you have established that framework, the phases you wish to attack and functions you have to accomplish in each phase, you create a matrix where you begin to get an insight into the technologies which must be constituent parts of a defense against ballistic missiles.

You must use the sensor capability, detection of the target, acquisition, discrimination of reentry vehicles from decoys, and then assessment of whether or not your firing was successful, the pointing and tracking of the interceptor weapon, actual destruction of the target by interceptor weapon overriding or bridging battle management of the entire system.

If we look at the ability to do that in the boost, post-boost, midcourse and terminal phases, you will in the boost phase require space-

based infrared sensors; post-boost and midcourse are likely to require energy capability for discrimination.

For that we are looking at space-based ultraviolet, visual or radar imaging sensors; for the terminal phase, airborne infrared or radar sensors.

The Talon Gold program, part of the DARPA triad program, offers a capability for pointing and tracking of all of the directed energy weapon concepts in space. And the terminal homing capability that is going on in the Army R&D program right now as well as the nonnuclear surface-to-air missile research is relevant to air intercept in midcourse and terminal phases.

You know Congress supported in 1984 a half billion dollars of research in the directed energy weapons area, as well as research in kinetic projectiles, and finally bridging the whole thing is the technology basis for battle management which includes not only the high-speed integrated circuit program which will give us the hardware, but also the development of new software tools, the kind of technology which will allow us to automatically program computer programs.

That becomes a very key element.

FUNDING OBJECTIVES

Prior to the President's speech $1.75 billion planned for relevant technologies:
- Infrared sensors for tactical warning of ICBM attack.
- Infrared sensors for space surveillance satellites.
- Precision pointing and tracking for directed energy weapons.
- Optical technology for airborne surveillance systems.

Homing "hit-to-kill" projectiles and associated chemically-propelled ground-based rockets:
- Neutral particle beam test bed.
- High power infra-red and visible wavelength lasers.
- X-ray laser concepts.

Strategic defense initiative approach in fiscal year 1985:
- Focus the originally planned work on new objectives.
- Augment key technologies and begin new work with a $250 million increase.

Mr. Chairman, all this technology is in fact underway in one shape or form in 1984, appropriated and approved by Congress. What we are doing is collecting a set of technologies that has already been underway and focusing it on the specific objective of defense against ballistic missiles. I will show you in a moment, but in addition to that, we are asking for $250 million to be added to what already are planned in these technologies for fiscal year 1985 to focus on the long poles in the tent, on the high priority items such as survivability issues raised here and the testing issues which necessarily must accompany that.

Senator LEVIN. $250 million in addition to what we already planned.

What had you planned dollar-wise before this new initiative?

General RANKINE. I have a chart specifically on that. The bottom line is that the Department of Defense would have requested about $1.57 billion, the Department of Energy about $0.21 billion for a total of $1.75 billion.

So, we are adding $250 million to that to bring it up to $2 billion.

I will describe for you now the whole set of technologies that encompass and constitute the research program that would be required.

PRIORITY TECHNOLOGIES

Boost-phase and post-boost vehicle intercept: Directed energy lethality definition against responsive threats has highest priority.
Discrimination and tracking of numerous RVs, decoys, and other material during midcourse and high reentry.
Survivability of space-based defensive assets when threatened with nuclear or "mirror-image" weapons.
Inexpensive interceptors for nonnuclear midcourse and early reentry kill.
Automated preparation and testing of battle management software.

Dr. Fletcher identified certain key priority technologies. He called them the long poles in the tent that had to be given priority attention and indeed the program that we are presenting specifically emphasizes those long poles in the tent.

First of all, the leverage that boost phase and postboost phase attack gives is one of the key elements to having an effective and cost-effective defense against ballistic missiles.

So, the pursuit of directed energy weapons and some of the conventional weapon techniques that could be employed against boost and postboost vehicles are critical.

Among the No. 1 priorities is the lethality testing. It is extremely important that we do the testing of the new directed energy weapon concepts against booster and postboost vehicles and investigate the degree to which the boosters and postboost vehicles could be hardened, what the implications are for greater power levels, brightness and energy levels, from the directed energy weapons, and in so doing establish fundamentally the feasibility of those directed energy weapons for that purpose.

Second, to identify the engineering characteristics, specifics for those weapons.

And third, identify the prospects between offense and defense which will lead us to that enlightened decision in the early nineties that will allow us to decide whether we want to embark on a defensive approach to stabilize the future because it appears to be more cost effective.

Along the same line of the cost effectiveness of the defense, the discrimination and tracking and inexpensive interceptors ought to be looked at in concert because the cost effectiveness of midcourse intercept is driven by our ability to discriminate true warheads from decoys or alternatively to drive the cost of decoys up so high in order to make them simulate effectively the warhead that you begin to trade the cost against a defensive system.

At the same time we will use technology to drive down the cost of the interceptors so that the net cost effectiveness of midcourse intercept will favor defense.

I have already mentioned the importance of survivability. That is a critical element of the program. We will go into the details of the measures we are investigating in a moment.

The preparation and testing of the computer program software development is a long pole in the tent that is going to be receiving considerable attention.

Senator WARNER. In that first boost phase postboost vehicle intercept, what are the potential platforms for our weapons?

General RANKINE. There are about five general classes of weapons that could be considered.

Three of them in the directed energy category, two of them in the kinetic energy category.

The first are classic space-based laser weapons which could be chemical lasers or electric lasers.

The second is the class of ground-based lasers which would have a laser on the ground, but by placing mirrors in space, we would achieve the same objective of being able to get the laser beam over the horizon for attack.

The third category is particle beam weapons. We will be saying more about each of those specific areas a little bit later.

Senator WARNER. There is no airborne platform, is there?

General RANKINE. There is no airborne platform being investigated in the program right now.

Senator WARNER. Conceptually?

General RANKINE. Conceptually, we leave that door open. It may be, for example, that the SLBM's in the boost phase might be better accomplished by airborne platform. That is being investigated in a study by the Air Force.

We have not drawn any conclusions on that yet.

Senator LEVIN. On this technology itself, can you give us the likelihood that we will be able to achieve technological success relative to the ICBM vis-a-vis the intermediate missiles?

I am very much interested in seeing reaction to this. How much more likely is it that we will be able to proceed with this program, with technological success relative to the long missiles vis-a-vis intermediate or short-range missiles?

General RANKINE. The best way to answer that is to think of the four layers. I believe right now if you start with the terminal phase, that is the technology that is the most mature.

As you go forward, it becomes less mature and a higher risk.

Senator LEVIN. Would you say it is significantly more likely that we will be able to technologically solve this, putting aside arms control and everything else, just technologically is there a significant increase in likelihood?

Dr. COOPER. Could I address your question, Senator Levin?

The issue between the IRBM's and both SLBM's and ICBM's is not an issue of great difference. There are differences in degree in certain of the performance parameters of those systems.

Where you get to some qualitative differences is in the short-range missiles; the SS–21 and SS–23 missiles that have ranges in the hundreds of kilometers.

When ballistic missiles achieve a range of thousands of kilometers, their essential performance parameters are roughly equivalent from the standpoint of these advanced types of systems.

If we are successful in being able to provide a large measure of capability against IRBM's, it is quite likely that we will be able merely by scaling up to a global perspective that same kind of technology to have substantial performance against ICBM's and SLBM's.

Mr. MILLER. By the same token, the more advanced conventional defenses, the faster burning nonnuclear tipped interceptors aided perhaps by airborne optical systems, are technologies which, while not currently in hand, are much closer to fruition than the advanced technology.

So, actually the possibility is that we would be able to develop an effective advanced terminal defense which could be used to defend main operating bases or POMCUS sites or weapon storage sites against tactical ballistic missiles far faster than we could develop the four-layer defense against the ICBM and SLBM threat.

Senator LEVIN. Mr. Chairman, could the record be kept open for additional questions?

Senator WARNER. Yes.

Mr. COOPER. Perhaps it would be worthwhile to go back one chart and address Senator Bingaman's question now about the issue of survivability and how conceptually we will approach that in relationship to Soviet capabilities as we view them in the future.

You addressed that briefly on the previous chart, Bob.

Perhaps I could preface that discussion by saying that in a large part of this program you will see that the substantial increases that have resulted in our request for the additional $250 million are in the area of survivability and the assessment of both how tough the Soviets can make their offensive systems against our defenses, and how the Soviets could actually achieve attacks on elements of this system is a key part of the program.

Now, the key part of the program is the intelligence assessment of what the Soviets can do today and what they can do tomorrow and what technology they can array against us, what effect it will have on the concepts of these systems and the potential for deployment.

There is a great deal of uncertainty in estimating both what capabilities the Soviets have today and what capabilities they are likely to have tomorrow.

So, our assessments have all been taken with a very conservative view of what the Soviets may accomplish in the future.

I think that you received in the recent hearing in the DIA assessment a very conservative view of what the Soviets may be able to accomplish.

We are hopeful in our technology program that we can meet the threat, the most conservative view from our point of view of what the Soviets may be able to do and still have effective systems.

We are taking an extreme view of what the Soviets may be able to accomplish in their own programs.

Do you have specific questions with respect to this issue?

Senator BINGAMAN. I was given a few questions that Senator Nunn wanted to have asked.

One of them I think pretty much describes my concern in this area. Let me read the question.

Given the report of Soviet progress, as reflected in recent CIA and DIA briefings to us, in ABM activity such as large-phased array radars, ABM interceptors, battle management radars and facilities, possible use of the SA–X–12 and such space and ASAT areas as armed manned space planes, permanently manned space stations, [deleted] lasers for ground-to-space and space-to-space use, we have been briefed in all those areas, but given that with all of this projected to be in operation by the late 1990's, according to these briefings, then aren't we behind the power curve with regard to this initiative?

That is the basic question.

Dr. COOPER. I think the answer to that basic question is that again there is a great deal of uncertainty about our assessment of what capabilities the Soviets have. I want to focus in on that word "capabilities".

Senator WARNER. Capabilities to do what?

Dr. COOPER. Capabilities to actually attack systems in space or to have an effective offensive capability against U.S. forces.

Senator WARNER. What do you mean by U.S. forces?

Dr. COOPER. For instance, our force structure in space, all of our satellites.

The question is what capability do the Soviets have?

What you have to do is go back and realize that all development programs go through a sequence of stages [deleted].

In research, for instance, it is very easy for the Soviets to hide what research they are doing, what basic research programs they have ongoing that could affect these systems. [Deleted.]

Next, generally when research pays off, comes some kind of demonstration of the feasibility of using that research to actually accomplish a military mission.

Often we are able to see things being done in the feasibility demonstration time period.

Now, feasibility demonstration is not a weapon capability. It only determines whether it is financially, technologically, conceptually from a mission point of view feasible to use a certain research result to create a new military capability. [Deleted.]

Then, depending upon what they decide about the feasibility and desirability of deploying the system, they will go into engineering development [deleted].

There is a long period of engineering development where they are designing, fabricating, testing [deleted].

Then there is deployment. We see that, we know what is going on, we are clearly able to [deleted] estimate what the real threat is.

If you look at the capabilities that would be used against our future strategic defensive systems, if we were to deploy them, or the capability that the Soviets might have to provide a reactive strategic offensive force threat to us, hardened ICBM's or whatever, by and large, none of those capabilities show up as deployed systems.

The deployed systems that they have clearly do not present a serious threat to the kinds of systems concepts that would come out of our Strategic Defense Initiative.

There is nothing in their deployed capability which says that we should not go ahead with this and we should not pursue it to the end. [Deleted.]

Senator BINGAMAN. Let me follow up, if I could, Mr. Chairman.

Then I guess you agree that it is possible for them to have these systems, the [deleted] lasers in space, ground-to-space or space-to-space use [deleted].

That is what I understood we were told. We are in a position of being asked to fund a program which will get us to a decision point so that in 1990 future Congresses will be asked at that point to decide whether to go ahead and develop the system, which presumably will take another 8 or 10 years, so that we are saying that it is very possible they

will have in operation a capability [deleted] which we will not be able to match until the late 1990's?

Dr. COOPER. To go back to the concept of where the Soviets may stand in the weapon system development, if they are in engineering development of some of those capabilities today [deleted].

So, we are talking about an IOC or potential IOC [deleted]. But certainly at a full operational capability that would be far into the 1990's.

So, I don't think that the Soviets are far advanced as to where we stand in many, if not most, of these technologies.

Again, there is great uncertainty about this and a conservative viewpoint that one might take would be to expect to see these things occur sooner rather than later.

Senator WARNER. We have to deal with short answers and short statements. Dr. DeLauer testified before the full committee 2 weeks ago and stated it would take "the United States a decade to catch up."

Am I not correct on that? Do you agee or disagree with that?

Dr. COOPER. What I heard Dr. DeLauer say, as I sat here, was that if we expand our research program as outlined in this program——

Senator WARNER. Which is a 5-year program?

Dr. COOPER. Yes, with the implication in the out years there are comparable spend rates, I heard him say that we would intersect this capability, what the Soviets are doing over the broad technology areas in about 10 years. I believe that is probably right.

Senator WARNER. He said catch up. You know, we have to deal with the public more than you do. After all, we have to get the public behind us to get these dollars.

Dr. COOPER. Certainly, but you have to realize that we have $1.75 billion. that we have programmed $1.75 billion as a nation in these areas to start with in fiscal year 1985.

We are talking about a $250 million increase.

Senator WARNER. I understand that.

His general statement was, given the program proposed by the administration at this time, it would take us a decade to "catch up".

Dr. COOPER. What that means is that we will have to increase our spending may be 14 to 25 percent over the next few years to be able to close the gap in certain areas from our perception of where the Soviets might be, not because we don't know where they are, but we are giving them the benefit of the doubt where we have doubts.

I think you are perfectly right. Certainly in some of the conventional capabilities——

Senator WARNER. Have you ever gone on TV when you have 20 seconds to answer questions? I had to do it last night on this subject.

Two points: The Soviets are ahead. It will take us a decade to catch up. We are communicators.

I am trying to help the members of the committee get a record together so that we can hopefully accept the President's program.

Dr. COOPER. That is certainly a fair representation.

Mr. MILLER. There are clearly areas where the Soviets are ahead in terms of the traditional ABM systems that they are now building around the Moscow area.

There also are certain areas of technology where much of the work that we have been doing is [deleted].

My colleagues from OUSDRE can talk to that in more detail [deleted.]

Senator BINGAMAN. You don't think the Soviets will have anything operational before the year [deleted] and beyond?

Mr. MILLER. Not in the sense of a total, layered advanced ballistic missile defense.

## STATEMENT OF JOHN L. GARDNER, DIRECTOR, DEFENSIVE SYSTEMS, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Mr. GARDNER. You have to answer that in a sequential way.

There is clear evidence that the Soviet Union is in a position now to deploy [deleted].

Senator WARNER. Of their what?

Mr. GARDNER. [Deleted.]

Exactly how fast it will take them to realize that is what Bob Cooper was talking about, [deleted].

Senator WARNER. Under the breakout theory, breakout from the ABM treaty?

Mr. GARDNER. [Deleted.]

It is also true that they have built an air defense system to go along with that and are upgrading their defense. That investment has been estimated to be [deleted] for the air defense system alone, the SA–10 and SA–12 deployment.

When you look at those two things and examine in addition the things they are doing [deleted] it causes you to want to considerably increase the pace of our program.

That is what we are coming here asking you to allow us to do.

Senator BINGAMAN. Some of the testimony that we got in the briefing the other day was with regard to these [deleted] as I understand it, in some of our satellites.

That was one of the items that was talked about.

As I was looking through this Fletcher report here, I tried to figure out what we are doing that seems to be a counterpart to that capability that exists or is about to exist.

All I could find, and tell me if I am missing something, is a thing called [deleted] lasers which we are proposing to fund at a level of $2 million this year, $3 million next year, $5 million the year after, $5 million the year after, and $8 million the year after.

That adds up to $23 million that we are going to spend between now and 1989 on this capability.

Is that the kind of accelerated program we need?

Mr. GARDNER. I think I will be able to describe to you some of the key building blocks of the program that we have underway.

One of the things that is addressed there is the ground-based lasers. I believe you will be able to see that the expenditures we plan in fiscal year 1985 alone are considerably in excess of the numbers you described there.

Almost $200 million is being programmed into the fiscal year 1985 program for ground-based lasers.

General RANKINE. If you will allow me, I would like to clarify one thing that is confusing the issue here, that is, the kind of sys-

tems which are needed to have effectiveness against current generation satellites and the kind of systems we are talking about for ultimate ballistic missile defense against perhaps hardened boosters.

The DIA briefing addressed the Soviet capability to possibly deploy a system [deleted] of the type we are talking about here is for the Soviets, as it is for us, in the latter part of the century.

May I ask Dr. Sellers to confirm if that is not the case.

Dr. SELLERS. [Deleted.]

[Chart deleted.]

Senator BINGAMAN. I understand. I think we saw that picture the other day.

My question is: If they are going to develop this [deleted] but if they are developing this, should we be spending $23 million in the next 6 years on this thing?

General RANKINE. Let me address that.

Given that there are different levels of power and pointing accuracy and technology required, we have been expressing to you today the program in the context of the ultimate objective of ballistic missile defense.

In the phase 2 ballistic missiles defense we will pass through a period of time when we will have capability to go into system development on laser weapons that would have sufficient energy power for a satellite capability.

One of those systems is ground-based Excimer lasers. We find the greatest potential to provide lethal energy in lower orbit, as a starter, is with the ground-based Excimer laser. It was started by Congress in 1984. It is funded in the 1985 program [deleted].

Senator BINGAMAN. You are talking [deleted].

General RANKINE. Yes, sir.

Senator BINGAMAN. [Deleted.]

General RANKINE. [Deleted.]

Senator BINGAMAN. [Deleted.]

Dr. COOPER. Could I address that issue?

[Deleted.]

We have also explored in great detail the technology and the problems associated with getting a laser beam from the surface of the earth out into space with sufficient quality so that it could be used to damage something at extended range. [Deleted.]

Senator BINGAMAN. I guess the answer is [deleted].

DIA thinks [deleted].

Dr. COOPER. No. The way I characterized it was that the intelligence estimates are based on what [deleted].

My assessment goes further than that. It takes into account work that we have done and some of the tough technical problems that I believe [deleted].

Senator WILSON. Will the Senator yield.

Senator BINGAMAN. Yes.

Senator WILSON. On the very point that Senator Bingaman has made, my concern is how is this research program geared to monitor and respond to your perception of some escalation activity?

As with every other weapon system, our response is based initially upon a threat assessment.

How do we stay abreast of the change in that threat assessment and do we have the capability as we perceive the changes in escalation to escalate our own effort?

Dr. COOPER. That is an excellent point.

The answer to the question is clearly yes. We are trying to assess both what the Soviets are doing and what we need to do to counter what they are doing.

In terms of the [deleted] lasers, we are making an investment and the investment we are making over the next 5 years we believe is consistent with the promise that those capabilities hold for success in the future.

Obviously, the Soviets have a different view of what the potential for success is.

As General Rankine pointed out, we are making extremely heavy investments in the short wave length ground-based excimer lasers [deleted] because we believe that technology is going to pay off.

We have experimental results, both in the fabrication of the laser and [deleted] that show the potential technology to be much greater, and that is the line we are going to be following.

But we will continue to experiment with the [deleted].

Mr. MILLER. One of the aspects of the program, which was described, is the emphasis on looking at the survivability of our own systems which speaks directly to the point of what systems the Soviets are working on are doing and how we might make a better, survivable ballistic missile defense.

Mr. GARDNER. [Deleted.]

Senator BINGAMAN. Let me follow up, if I could, Mr. Chairman.

I gather what I am hearing is that the Soviets have gone forward [deleted]. It is our judgment, scientifically I gather, that there is more promise in the excimer than there is in this.

So that we are by virtue of deciding to put $23 million into [deleted] and $200 million or some such figure into excimer, we are gambling that we are right [deleted].

Dr. COOPER. I guess I would put it slightly different.

We are following our best judgment as to where the payoffs lie in terms of investing public dollars, but we are hedging by spending the smaller sum of money to explore the details of the [deleted] approach so that we fully understand what the potential is.

We are spending in that particular technology area at a rate which will, we hope, avoid technological surprise [deleted].

Senator BINGAMAN. Mr. Chairman, I think that is crucial to Mr. Perle's testimony. [Deleted.]

Dr. COOPER. [Deleted.]

Senator WARNER. Secretary Perle was concerned about the inability to devise effective anti-satellite arms control arrangements because of the limited, if not impossible, means of verification.

I think he stressed the verification aspect, using as an example that the boost system for the Soviet ASAT system is quite comparable to the boost systems for a variety of other military systems, ergo, you could not distinguish what they are doing within certain treaty limitations and beyond those treaty limitations.

Senator BINGAMAN. In order that I can be prepared for a 20-second response on television, my understanding of what you are saying, Dr. Cooper, is that in the technologies that we believe will turn into effective capability, we are ahead of the Soviets, they may be ahead in deploying some types of systems, they may be ahead in other types of technologies which we are monitoring and doing work on, but that we are not, in fact, behind the Soviets in our development of effective capability in this area?

Senator WARNER. What area again?

Senator BINGAMAN. The area of a ballistic missile defense, the technology necessary to have an effective ballistic missile defense.

We are ahead in that technology. That is what I am understanding. It makes a difference. If we are playing catch up and this is an attempt to catch up with the Soviets, that is one thing.

If, in fact, we have a lead and are trying to maintain a lead, that is a very different situation.

I would like to know.

I am wondering about our judgment. I understood Dr. Cooper to say that our judgment is that in the technologies that will produce an effective ABM system we are ahead of the Soviets.

Dr. COOPER. I was speaking specifically about this particular technology, that is, the technology of [deleted.]

In that particular area I would guess that the Soviet Union is ahead of us. They are certainly ahead of us in how much money they are spending on the program.

But in areas where we feel there is great potential we feel that perhaps we may be ahead in those areas. I picked out the excimer laser as a kind of example of the technology that is here.

We do believe that we have some lead over the Soviets in that area. I think that, as Frank was about to say, I am sure, over the broad areas of technology that apply here, including both the conventional and the advanced technologies, I think on balance the Soviets are probably ahead of us, ahead of us to the extent that if we both run at the pace that we believe they are running and we believe we will be running when you authorize and appropriate the program for 1985 and beyond that we are asking for, that we will generally be even with them in the decade of the nineties.

Senator WARNER. Let us go back to Dr. DeLauer's statement because that is way out in the future.

Are you changing that?

Dr. COOPER. No. I am saying it will take us a decade, spending at an increased rate before the broad technology area will be roughly equal for the Soviets and for us because they are not standing still in the interim.

They are spending in the laser area an estimated three to five times as much as we are.

Now, we are good, but we may not be three of five times as good as they are. But with just a little bit more expenditure, say 20 percent, we may be able to offset that three to five times expenditure.

That is, we are that much better than they are.

Senator WARNER. It is still consistent with his generalized statement?

Dr. COOPER. That is right.

Senator WARNER. Somehow your question rang a bell in my ear to the effect that that differs from what Dr. DeLauer said.

Senator BINGAMAN. I understood we were ahead in the technologies that matter and now I am hearing we are not ahead.

I think it is relevant.

Mr. MILLER. You were discussing only this particular portion of the particular laser program. There are other laser programs and neutral particle beams which you and Dr. Cooper have not been discussing.

Senator BINGAMAN. I assume that this Fletcher commission worked to decide which technologies were the ones that would bear results or bear fruit down the road as far as capability is concerned.

My understanding is, or was until the last few hearings, that we were ahead in the technologies that matter and maybe they made the wrong judgment as to which technologies matter.

This is sort of a blind alley they have gone down as we see it.

Dr. COOPER. We have been down that alley.

Senator BINGAMAN. We have been down that alley. We think they are wasting money on this thing?

General RANKINE. We don't think that would be the most cost-effective way of accomplishing the objective.

I think you might equate this to the White Sands Missile Range where we have the new chemical laser in your own State.

[Deleted.]

From the standpoint of our ability to be ahead in that particular technology in that kind of chemical laser, that is probably the highest powered laser in the world so far as chemical lasers are concerned.

The Soviets are farther ahead in this area. Dr. Fletcher said there are many technologies that may bear fruit and they have focused in on a handful of them as being the ones that show the more promise.

It appears to us that the Soviets have also picked a handful, but they are not necessarily an overlapping handful.

So, in some areas they are spending more money than we are, in some areas less money.

[Deleted.]

In chemical lasers we are ahead.

[Deleted.]

We have to evaluate each one piecemeal. When you look at that whole integrated set, what it appears to us is in the net if the Soviet keep moving the way they are and we keep moving the way we were prior to the Strategic Defense Initiative, the Soviets would get to the point where they could field an effective ballistic missile defense system before the United States.

It is that concern which generated the Strategic Defense Initiative.

Senator WARNER. Senator, what is your view of the subject because I want to make sure we have the facts.

Senator WILSON. You are going to be the ones who will be here in 1990.

Senator BINGAMAN. I am not sure that is true.

It just strikes me that we are taking very speculative information with regard to potential Soviet capability.

Senator WARNER. Generally speaking in the ABM area?

Senator BINGAMAN. And we are building it up as a likelihood for purposes of public consumption. The public is out there thinking these guys have all kinds of capabilities.

We are also using it in policy decisions such as whether to go ahead in the antisatellite arms control area. I think it may be unwise to extrapolate that far from what we are seeing up here.

Senator WARNER. You have a legitimate point in questioning the facts on which we have drawn certain conclusions.

Senator BINGAMAN. They could extrapolate from us. [Deleted.]

They may believe in the Soviet Union we have that capability today and we can knock out their satellites and, therefore, they should not pursue arms control with regard to satellite weapons.

It strikes me that we are making policy judgment on extremely flimsy information.

Senator WARNER. Our colleagues are relying on members of this committee to sort out factual data and go to the floor and make representations on which they can place trust in our judgment.

I think at this point we had better ask the CIA if they would like to comment on this.

Senator WILSON. Mr. Chairman, before we get to CIA, I wonder if I might have the indulgence of the Chair.

I am delighted that this panel is here this morning because as the record will show, I was a little less than pleased with the overall impression left by the appearance of Dr. DeLauer and Secretary Ikle. That is no disrespect; they are two good friends.

I think clarification is required and referring to the general dialog between Senator Bingaman and the members of the panel, I would like to ask some broad questions. I must say that I have listened with keen interest and my own impression, listening to the questions and the answers in the dialog between Senator Bingaman and the panel, is that we probably need to spend more on this program.

I am very concerned that we be in a position to continue to monitor the threat assessment and be in a position where we can conduct some kind of research breakout that is required.

That is predicated on certain assumptions which I will pursue now.

Let me ask you, Dr. Cooper. First in testimony received by this subcommittee a couple weeks ago on this whole subject, it seemed to me there was some ambiguity.

Is it a goal of this program to provide for substantial protection of urban industrial assets?

Dr. COOPER. Perhaps Frank Miller could address that question.

Mr. MILLER. Senator, the answer is yes in its broadest sense. Let me explain that further.

The system that we are talking about in its broadest terms, would attack and destroy incoming reentry vehicles in the boost, post-boost, and mid-course phases before we even knew where they were going.

Reentry vehicles intended for use against cities and industrial targets clearly would be destroyed very early on.

Now, the last phase, the terminal phase, could be deployed in any number of areas. It could defend military targets, it could defend urban areas as well.

The overall point is that a system of this sort, if effective and survivable, would increase our ability to deter war.

By increasing our ability to deter war, it would reduce the possibility of war. This would have a very, very high payoff in terms of protecting civilian life, because there would be decreased chance of war and decreased possibility of attack on the United States.

Furthermore, if there were accidents or miscalculations, the system would also serve to attack and destroy warheads that will come at the United States.

I think the answer is absolutely yes in its broadest possible sense. It increases deterrence and if there were an accident or deterrence failed, it would contribute substantially to destroying warheads which were aimed at U.S. populations.

If I could say one more thing in commenting on what you and Senator Bingaman were saying. One of the discussions about where we are in relation to the Soviets today was one of the policy reasons for going forward with all of this, but it was only one.

The hedge chart that I put up was one of a number of reasons.

A second and very important one, is the one you mentioned, that is, if we can build an effective and survivable defense, then that contributes to reduced risk of war and that it will, in the event of accident or miscalculation, be able to reduce subsequent losses should deterrence fail.

But until we conduct further research to understand what the Soviets are doing and what the possibilities are for ourselves, we can't provide you some of the very hard answers in an absolute yes and no sense.

You were, in essence, making one of the cases for the research and development program. The answers to the questions about going forward to deploy would be based on the results of the research.

Can an advanced defense system be made effective? Can it be made survivable? We can't tell you that now.

Are the Soviets going down a dead end alley? We can't tell you that either until we carry out an overall research program.

Senator WILSON. I quite agree with that assessment.

I would say that there are two reasons to engage in this.

One is because of what the Soviets may be doing. Wholly apart from that, it seems to me that a second reason and a compelling reason is that, as I understand it, a goal of this program is to offer the potential for a substantial reduction ultimately in the strategic offensive weapon system if in fact it can achieve full potential of the multilayered, three-stage intercept.

Mr. MILLER. And be made survivable.

Senator WILSON. And be made survivable. That is a goal?

Mr. MILLER. Yes.

Senator WILSON. Is it then not also a goal and admittedly a less important one than achieving the elimination of the major threat of war, but isn't it true that if we could finally achieve that level of defensive capability instead of continuing to rely upon the kind of deterrence based upon mutual assured destruction that leads to an arms race conceivably without end, that we will also achieve very significant fringe benefits in terms of the costs that are associated with our total deterrence scheme?

Mr. MILLER. I believe the answer to that also is yes.

The first point is that a world without ballistic missiles on either side would be a more stable world.

If the Soviets are developing advanced defenses along these lines, as you are saying, at some point in the next several decades we will not need a follow-on to the Trident II or follow-on to the smaller ICBM because the Soviet defenses would mean that those ballistic systems would no longer be effective.

I did say earlier that when we talk about the overall U.S. deterrent policy which is linked also to the defense of Europe against conventional attack and which currently relies on some threat of nuclear retaliation in the event of failure of our European defenses, that there could be some role, even with this initiative, in the future for airborne or cruise missiles, "slow flying," nuclear weapons.

If we are able to develop other technologies that will truly support a conventional only defense against the tank armies, then the role even of slow flying nuclear systems might be eliminated as well.

Thus, the answer is yes, because certainly if this works, the ballistic missile leg of the offensive deterrent would be reduced substantially.

Senator WILSON. Concentrating for the moment just on the aspect of defense against ICBM's, it seems to me that there is incredible payoff that is well worth the research if the effort is successful.

In fact, it is that very fundamental point that I think deserves a great deal more stress than has been given.

I am sorry my colleague, Senator Exon, is no longer present because he has been concerned, and rightfully so, with the possibility of a brand new arms race and the thought that we may find that resources that we are already spreading thin will be spread thinner.

It seems to me that the fundamental point to be made is that this race, as you term it, is a race that has a finish line in contrast to a scheme of mutually assured destruction on which there is no finish line in sight.

Mr. MILLER. The SDI could be used to defend against Soviet ballistic missiles in Europe, conventional as well as nuclear arms and thereby increase deterrence of not only nuclear war, but conventional war.

There could be a significant payoff to deterrence and stability in the European theater and on an intercontinental basis if we can make an advanced ballistic missile defense effective and survivable.

Senator WARNER. It seems to me there is one other aspect of what I call a deep study of this question, where I can get away from everybody and sit down and reflect and look at this picture.

We have received testimony about [deleted] road mobile, and it seems that the Soviets are going into dispersal, a mobility system whereby if he breaks down the effectiveness of command and control, it raises the potential incidence of miscalculation or accident.

To the extent that we can have a system here in the United States that would intercept a stray round or two coming in, the better off we are against triggering a confrontation.

I say this from over a decade of experience in this area of public service. I am a strong advocate of arms control, but, as I see these systems for the future, approaching fundamental principles of mobility, it strikes me that arms control is becoming more and more difficult.

It might well fracture the ability to have arms control in a decade or two. If we don't have progress in the defensive systems, we could be in a fix.

Would you care to comment on those two hypothesis because they trouble me a great deal?

Dr. COOPER. It is clear that the mobile systems present an extraordinary problem for arms control and also present an extraordinary problem for military folks in understanding what to do, what makes sense to do about those systems as they proliferate.

Mr. MILLER. Two further points.

I don't want to speak against mobility in the current aspect of modernizing the U.S. ICBM force. Mobility is a key part of the Scowcroft conclusions. On the other hand, if you were able to intercept effectively ballistic missiles, then you would not need to deploy your own mobile, because the Soviet systems, whether they were mobile or fixed would be ineffective. If you look down the road toward arms control, not only does arms control help develop a transition regime for more emphasis on slow-flying offensive systems, but as you look down the road, if ballistic missiles are losing their military and, therefore, their political utility, then there is increased emphasis on reaching agreement which would reduce their numbers.

There is not even a political threat from ballistic missiles if you can block them in a military sense.

Again, I want to stress the point that the research program will tell us if we can do it and if we can do it in a survivable manner.

Senator BINGAMAN. Mr. Chairman, I am not opposed to the research program, but I have great difficulty—and I think Senator Exon's comment indicates he does too—I have great difficulty with the idea that we are going to develop a technological fix to the arms race which is sort of what I think you are trying to describe to us.

Mr. MILLER. No, sir.

Senator BINGAMAN. That some way or other if we build an effective enough defense, people will back off the offense.

I would think the natural human response would be to do just the opposite, that the more an effective defense is constructed, the more likely we would be, and the Soviets would be, to increase our offensive capability with the hope that we could maintain some ability to get through the defense.

Dr. DeLauer testified that he did not see any chance for a reduction in offensive weapons as a result of what is being proposed on the defensive side, at least in his lifetime.

I don't know if you are now saying that is not accurate or you are saying maybe your lifetime will be longer than his, bringing in the younger generation to argue this.

When do you see us reducing our offensive capability even potentially? Because I think that is a false promise to hold out to the American people based on everything I have heard.

Mr. MILLER. Let me go back and say a number of things.

The first is that the research program that has been discussed here, if successful, would lead you to the ability to make decisions in the nineties on whether to deploy systems after the turn of the century and perhaps some intermediate deployment in the European area before this.

So, if you are talking about when could fully effective defense be in place that would strip away the political and military value of ballistic missiles, then, yes, we are talking about the next century if we can make it survivable and effective.

The second point I made to you earlier is that we still have to find a way to deter the tank army in Europe, the Soviet tank armies and the Soviet conventional aggressive capability.

There are still Soviet aircraft and cruise missile programs. How one maintains linkage and flexible response will always be important.

The question of advanced technologies is another problem. All I was saying is that if this kind of research yields a system that can strip away fast-flying missiles, you will increase stability by giving yourself more warning time.

You will take away part of the tools the Soviet planner would use in an attack.

Senator BINGAMAN. Aren't you also saying once we have such a system, there will be the incentive or something to reduce our offensive capability and, therefore, we are going to save money because we are doing this?

Mr. MILLER. I said if ballistic missiles are not effective, it does not make sense to come up with a new generation of ballistic missiles.

Senator BINGAMAN. And it does not make sense to channel your offensive capabilities into other areas that are not countered by this ballistic missile defense?

Mr. MILLER. I said there would continue to be a role, in my personal opinion, for bomber aircraft and cruise missile programs.

Senator BINGAMAN. So, when do you see this payoff occurring? When do you see the reduction in our offensive, the opportunity to reduce our offensive capability?

Mr. MILLER. I don't know.

Dr. COOPER. Certainly in the millennium.

Senator WILSON. How do we know that without conducting research?

Mr. MILLER. The Fletcher study, when it looked at the potential threat, looked at a Soviet reentry vehicle force three to four times as large as the current one.

That the Soviets could proliferate offensive systems to beat defensive systems was one possibility the Fletcher people looked at and said needed to be taken into account.

The research program they devised would be intended to defend against possible Soviet reactive threats not just current Soviet threats. It is not a defense that could be overwhelmed easily.

I am saying we don't know the answers to these questions. We can't make informed decisions on deployment now.

Dr. COOPER. Clearly what Dr. DeLauer meant in his previous statements was that it clearly is going to be into the next century, which is also into the next millennium, before the opportunities will be there if we are successful and if we actually deploy these kinds of systems, the opportunity will be there to begin thinking about backing off on the sizes of strategic offensive forces on both sides.

He was just pointing out that he may not see that millennium, he may not be around for that, but he certainly believes we should work on these technologies to potentially make that possible in the 21st century.

Dr. SELLER. I don't have anything that would be in direct conflict with what they are saying.

I would like to separate some of the role of the U.S. systems versus what we see for the Soviets.

[Deleted.]

[Deleted.]

We are talking the next decade for that type of role.

Senator BINGAMAN. What kind of laser is that again? [Deleted.]

Dr. SELLER. No. [Deleted.]

Senator BINGMAN. What kind of laser are they going to put in space [deleted].

Dr. SELLER. There are several potential types that we think possibly could be that.

[Deleted.]

Senator BINGAMAN. [Deleted.]

Dr. SELLER. That is the earliest possible time we think they can do that. [Deleted.]

I think the more likely judgment is in the early nineties.

Senator BINGAMAN. My understanding was that the power source to have any kind of effective laser would be pretty heavy.

Am I wrong on that?

Dr. SELLER. That is true. We have looked at that. [Deleted.]

Senator BINGAMAN. Why don't we do that if they are doing it?

[Deleted.]

Dr. COOPER. We could choose to do something of that sort.

[Deleted.]

We could put that into space and try it out certainly by the early nineties.

The question is why would we want to do that? [Deleted.]

So, the decision to do that from our point of view would be taken in the 1988 time period. It could actually be accomplished by the early nineties, but it would probably have no substantial ballistic missile defense capability.

Senator WARNER. I think that we have to now allow Mr. Gardner to give his statement.

Have you completed.

Dr. SELLER. I wanted to add a comment.

The role we have gotten mixed was the ASAT role and verifiability issue. [Deleted.]

Senator BINGAMAN. Mr. Chairman, let me say that the thing that concerns me is the more you press on this Soviet capability to do these things [deleted].

All we know is that they [deleted]. This is not the way it was presented in the initial briefing. That is my concern.

We were told that they have the capability to [deleted].

Now I am understanding that they [deleted].

Dr. SELLER. If someone said that was a hard and fast thing, they are wrong. If they hold it open as a distinct possibility, it is right.

It is how it was qualified when it was said. I object to the way you characterize it. We perceive the Soviet——

Senator WARNER. Where in the pecking order is that team versus yours?

Dr. SELLER. I am the branch chief of the Strategic Defense Office. They are in the Space Branch. The Space Branch used to be part of my branch, but they split off last year.

Senator WARNER. Will you take the opportunity to avail yourself of the briefing we received? It is clear to the Chair and ranking minority member and other members of the committee that we are going to have to ask the various defense-related government departments and agencies to review this record and help us reconcile these differences because we have had some differences in testimony.

I do not suggest in any way one department is sniping at the other. But the Senator pointed out the gradations of the adjectives, emphasis, things like that, portraying a somewhat unclear picture to the committee.

Senator WILSON. Mr. Chairman, I would only add that it is imperative to pursue this kind of research which arises from two different aspects and that if only one were present, it would still be worth the effort.

If the Soviets were doing nothing in the area of defensive capability, what they are doing in the way of offensive capability, it seems to me, makes it imperative.

Senator WARNER. Now, have you been able to complete your statement?

Dr. SELLER. I want to make one other point.

Senator WARNER. Go ahead.

Dr. SELLER. We perceive from an intelligence point of view the Soviets' [deleted].

I don't think you will find anybody that will soften that in the intelligence community. These would be [deleted].

Senator BINGAMAN. I understand [deleted].

Dr. SELLER. [Deleted.]

Senator WARNER. Now, Mr. Gardner, you have been patient.

Mr. GARDNER. Let me spend a few minutes going over the details of the program that we have in front of us.

There has been a lot of discussion about the program. We thought we would spend 20 minutes to try to clarify the institutional program, what it consists of and to give you some sort of sense of the major initiative of the program.

The program is aligned into five major areas. These areas are those consistent with the principal function of the ballistic missile defense, surveillance, acquisition, and tracking; two kinds of weapon programs, those associated with the directed energy systems as well as the kinetic energy weapons; and two supporting pieces of work, one supporting a piece that is a system-oriented work to ensure that the program is properly focused and is concentrating on those areas in which the payoff is the greatest.

We have had a lot of discussion this morning about that. This program is intended to continue to examine the issues of where is the most promise, and to ensure that the focus of the R&D program

is concentrated in those areas and the monies being spent to do that is in those areas.

We have talked about survivability and lethality. That area was so important that we broke it out of these three major areas. This action provided additional focus and concentration on it to assure that this very important question of "can the system be made to survive a direct attack on it," could be answered quickly and expeditiously.

We have focused a great deal of attention on that as well as the question of lethality.

The lethality question is based upon the interactions between the hardening of the boosters and brightness of the directed energy weapons.

Now, it is also important to note the amount of money that is being spent in this area. In fiscal year 1984 we are spending not quite a billion dollars on programs that are associated with these areas. We had planned to spend slightly more than one and a half billion dollars in this area prior to the President's initiative of last March.

We have now increased that by $250 million with substantial increases, as you can see, in the survivability and lethality area, substantial increases in directed energy weapons, and a relatively stable funding in the area of surveillance, acquisition and tracking.

That stability was warranted because a significant increase in funding was already planned in that area, largely in response to the fundamental issues associated with the survivability of the space-based element of our entire military structure.

So, we had intended a significant expansion in that area already.

That is an overview of the program that we are recommending.

Senator WARNER. At some point I would request a submission for this record to show of the $1.75 billion that was in place prior to the President's announcement, what portion of that was initiated by previous administrations.

Dr. COOPER. We will be happy to provide that to you.

[Chart deleted.]

Senator WARNER. Off the top, what do you think?

Mr. GARDNER. Most of these programs that existed in this $1.5 billion were programs that had been underway in various forms for some time.

Senator WARNER. Meaning under President Carter and President Nixon?

Mr. GARDNER. Right.

Senator WARNER. We are trying to break out that delta that can be directly attributed to the current administration, $250 million.

Dr. COOPER. In the directed energy weapons area there has been essentially no change from previous administrations.

That plan has continued on pretty much undaunted across the administrations.

In some of the other areas I would hesitate to try to guess.

Mr. GARDNER. Here is a chart that summarizes some of the major projects.

[Chart deleted.]

Senator WARNER. We are getting into details. I am not suggesting that any of my colleagues will look at it from a political perspective, but in the event that comes up, I want to be prepared.

Mr. GARDNER. The thing that I want to do now is to spend a few minutes going over each one of these program elements and highlighting for you the major activities that are going on.

Senator WARNER. Have you had an adequate opportunity to discuss in a bipartisan way the difficulty before the members of the committee? Give us the high points.

Mr. GARDNER. The thing I decided I would do for the sake of brevity is give you a brief summary of these five program elements that I have summarized in total previously and identify just some of the highlights of the program elements. That will make clearer some of the discussions we have heard prior to this.

[Chart deleted.]

This program element is the one associated with surveillance, acquisition, and tracking. It provides information necessary for the system, all that work associated with collecting and disseminating the information on the threat, finding it, tracking it and deciding which of the objects are lethal and must be destroyed and which ones are decoys and we are not required to act.

The program is broken into two major pieces. These elements here are elements associated with technology development. The developments here are the elements associated with the demonstration of technology that we believe is far enough along that it warrants some fairly major expenditures for demonstrating capability.

Perhaps first it is appropriate to talk about these demonstrations because they are to a significant extent the heart of this particular program.

[Deleted.]

So, we have refocused those two programs.

[Chart deleted.]

We have a major amount of money planned for technology development. These are technology areas where we don't know enough now to initiate major demonstrations in this area.

It will be several years before we are in a position to do so. That bears importantly on the case of the imaging radars or lasers which are a major part of this program and you can see here where we have had some significant expansion.

We would hope to be able to demonstrate technology that will allow us to make pictorial images of the bodies coming off ballistic missiles from thousands of kilometers away, using either lasers or radars.

So, there is a significant amount of technology involved here as well as significant expansion in our overall ability to build very large arrays for mosaic optical sensors that will support generation capabilities of the kind described here.

This technology is very broadly gauged and we believe important in a number of areas, including strategic defense.

Senator BINGAMAN. Mr. Chairman, could I ask about that imaging laser?

We have 1,212 percent real growth this year, as I understand that.

Can you give me a little more information on what that is, where that technology is going or why we didn't do more?

You can make the argument that we were working on it before, but to go from $5.6 million in 1984 to $76.9 million this year is a pretty big jump.

Mr. GARDNER. That is correct.

The objective of this technology is to be able to build high powered, coherent lasers that are capable of measuring the image of what the object would look like.

This program would look at several different wave lengths for such laser techniques.

In the past it was not considered so important because we were not attempting to aggressively do the quality of defense necessary to utilize this kind of capability. That is, the thing that came out of the defensive technology study was that of being able to examine what the Soviets were deploying, of their ICBM's what was essential in supporting defenses.

These are the kinds of capabilities, the laser and radar, that are the kinds that can do that.

We previously had a relatively low keyed program in this area, essentially moving along at a relatively slow pace. As a result of the Fletcher study in this area, we looked at an aggressive expansion of that program based on the technology that appeared to be available in one of two areas, either in relative short wave length lasers or carbon monoxide lasers.

Senator BINGAMAN. Also Dr. Cooper testified before, I think the statement was, that 5 percent of that money was going to new and innovative technology and that as a priority that 5 percent should be funded before any of the rest of it.

That was my understanding. The 5 percent is not broken down, I assume, it is a catch-all somewhere.

Mr. GARDNER. Not specifically broken down, no, sir.

Senator WARNER. I will have to interrupt.

I am going to have to be absent myself. You may continue, Senator. Go ahead and chair the remainder of the hearing.

Senator BINGAMAN. Mr. Chairman, I am going to have to vote also. How do you want to do this?

Senator WARNER. I think we can terminate for the day, recognizing we will submit questions after we examine the record.

We offered Mr. Gardner 20 minutes uninterrupted.

Senator BINGAMAN. You will still get it someday.

Senator WARNER. We will need the briefing for the record.

[The briefing charts follow:]

# STRATEGIC DEFENSE INITIATIVE FY85 KINETIC ENERGY WEAPONS BUDGET

($ MILLIONS)

| MAJOR TECHNICAL AREAS | FY84 APPROPRIATION IN RELATED AREAS | FY85 PLANNED PRIOR TO PRESIDENT'S SPEECH | FY85 SDI BUDGET | % REAL GROWTH* FROM FY84 | % GROWTH FROM FY85 PRIOR PLAN | PRIMARY USE |
|---|---|---|---|---|---|---|
| TECHNOLOGY DEVELOPMENT | | | | | | |
| ENDOATMOSPHERIC NONNUCLEAR KILL | 113.8 | 143.6 | 80.5 | -32 | -44 | TERMINAL |
| EXOATMOSPHERIC NONNUCLEAR KILL | 0 | 5.0 | 65.7 | NEW | 1,214 | MIDCOURSE |
| HYPERVELOCITY LAUNCHERS | 13.2 | 14.1 | 22.5 | 63 | 60 | BOOST |
| NOVEL CONCEPTS | 2.3 | 2.0 | 11.0 | 357 | 450 | ALL PHASES |
| HARDWARE DEMONSTRATION | | | | | | |
| ENDOATMOSPHERIC NONNUCLEAR KILL | 36.8 | 78.6 | 74.0 | 92 | -6 | TERMINAL |
| EXOATMOSPHERIC NONNUCLEAR KILL | 24.2 | 52.8 | 40.0 | 58 | -24 | MIDCOURSE |
| HYPERVELOCITY LAUNCHERS | 0 | 0 | 3.5 | NEW | NEW | BOOST |
| KINETIC KILL VEHICLES | 5.5 | 0 | 40.0 | 595 | — | SPACE DEFENSE |
| TERMINAL DEFENSE SYSTEM | 0 | 0 | 18.9 | NEW | NEW | TERMINAL |
| | 195.8 | 296.1 | 356 | 74 | 20 | |

*ASSUMES 4.7% INFLATION

# SYSTEM ANALYSIS AND BATTLE MANAGEMENT

SYSTEM ANALYSIS

- RESPONSIVE THREAT: TIME-PHASED THREAT, ATTACK SCENARIOS AND SOVIET DESIGN/OPERATIONAL CONCEPTS
- SYSTEM ANALYSIS: REQUIREMENTS, CONCEPT SCREENING, INITIAL ARCHITECTURE ASSESSMENT, REFINED REQUIREMENTS
- BM/$C^3$ ARCHITECTURE: CONCEPTS EVALUATION, SIMULATION/ANALYTICAL MODELING

BATTLE MANAGEMENT/$C^3$ TECHNOLOGY

- FAULT TOLERANT PROCESSING: FOR ALTERNATIVE CONCEPTS IDENTIFY: COMPUTATIONAL REQUIREMENTS, CRITICAL TECHNOLOGIES, AND OPERATIONAL ENVIRONMENT
- FAILURE FREE SOFTWARE TOOLS: ARCHITECTURAL CONCEPTS, SOFTWARE TOOL/AIDS DEVELOPMENT, ARTIFICIAL INTELLIGENCE
- WEAPONS CONTROL/RELEASE: SIMULATION/ANALYTICAL MODELING, SAFETY DOCTRINE, TECHNOLOGY ASSESSMENT
- COMMUNICATIONS NETWORKS: COMMUNICATIONS ARCHITECTURES FOR SYSTEM CONCEPTS, NETWORK MODELING, NETWORK MANAGEMENT
- BATTLE MANGEMENT ALGORITHMS: ADAPTIVE APPROACH, REAL TIME RESOURCE ALLOCATIONS

2725.4

# STRATEGIC DEFENSE INITIATIVE FY85 SYSTEM ANALYSIS AND BATTLE MANAGEMENT BUDGET

($ MILLIONS)

| MAJOR TECHNICAL AREAS | FY84 APPROPRIATION IN RELATED AREAS | FY85 PLANNED PRIOR TO PRESIDENT'S SPEECH | FY85 SDI BUDGET | % REAL GROWTH* FROM FY84 | % GROWTH FROM FY85 PRIOR PLAN |
|---|---|---|---|---|---|
| SYSTEM ANALYSIS | | | | | |
| RESPONSIVE THREAT | 3.5 | 3.5 | 9.0 | 148 | 157 |
| SYSTEM ANALYSIS | 49.3 | 44.1 | 39.0 | -24 | -12 |
| ARCHITECTURE | 7.8 | 8.0 | 7.9 | -3 | -1 |
| BATTLE MANAGEMENT/ C³ TECHNOLOGIES | | | | | |
| FAULT TOLERANT PROCESSING | 9.7 | 11.0 | 11.5 | 13 | 5 |
| FAILURE FREE SOFTWARE TOOLS | 6.4 | 9.0 | 10.6 | 58 | 18 |
| WEAPONS CONTROL/RELEASE | 1.0 | 2.0 | 1.0 | 282 | 200 |
| COMMUNICATION NETWORKS | 2.2 | 4.5 | 9.0 | 291 | 200 |
| BATTLE MANAGEMENT ALGORITHMS | 2.8 | 7.4 | 8.0 | 173 | 8 |
| DOD TOTAL | 82.7 | 89.5 | 99.0 | 14 | 11 |

*ASSUMES 4.7% INFLATION

# SURVIVABILITY, LETHALITY, & SUBSYSTEMS (SUPPORT PROGRAMS)

★ SYSTEM SURVIVABILITY:
TACTICS & TECHNOLOGY (DECEPTION, SHIELDING, MANEUVER, PROLIFERATION, SELF DEFENSE) FOR FUNCTIONAL SURVIVABILITY

★ LETHALITY & TARGET HARDENING: CONDUCT TESTS TO DETERMINE–

- EFFECTS OF CANDIDATE WEAPONS
- VULNERABILITY OF HARDENED TARGETS
- OBSERVABLES OF TARGET DESTRUCTION

BASIS FOR:
- WEAPON DESIGN
- SURVIVABILITY DESIGN
- COST EFFECTIVENESS
- KILL ASSESSMENT
- THREAT DEFINITION

• SPACE POWER & POWER CONDITIONING:
TECHNOLOGY FOR MEGAWATT LEVEL ELECTRICAL POWER SOURCES FOR SPACE SENSORS AND WEAPONS.

• SPACE LOGISTICS:
HEAVY LIFT & ORBITAL TRANSFER REQUIREMENTS & TECHNOLOGY.

2725-4

# STRATEGIC DEFENSE INITIATIVE
# FY 1985 SUPPORT PROGRAMS BUDGET

($ MILLIONS)

| MAJOR TECHNICAL AREAS | FY84 APPROPRIATION IN RELATED AREAS | FY85 PLANNED PRIOR TO PRESIDENT'S SPEECH | FY85 SDI BUDGET | % REAL GROWTH* FROM FY84 | % GROWTH FROM FY85 PRIOR PLAN |
|---|---|---|---|---|---|
| 0010 SYSTEM SURVIVABILITY | 10.9 | 13.2 | 36.2 | 217 | 174 |
| 0011 LETHALITY AND TARGET HARDENING | 12.6 | 15.4 | 63.6 | 382 | 313 |
| 0012 SPACE POWER AND CONDITIONING | 0 | 8.0 | 11.0 | NEW | 38 |
| 0013 SPACE LOGISTICS | 0 | 0 | 1.5 | NEW | NEW |
| DOD TOTAL | 23.5 | 36.6 | 112.3 | 355 | 206 |
| DOE TOTAL | — | — | 20 | | |

*ASSUMES 4.7% INFLATION

2725-4

# STRATEGIC DEFENSE INITIATIVE
# PROGRAM SUMMARY

ULTIMATE GOAL: "INTERCEPT AND DESTROY STRATEGIC BALLISTIC MISSILES BEFORE THEY REACH OUR OWN SOIL AND THAT OF OUR ALLIES" (PRESIDENT REAGAN, MARCH 23, 1983)

RESEARCH PROGRAM GOAL:

DEVELOP AND DEMONSTRATE RELEVANT TECHNOLOGY SUFFICIENTLY TO PERMIT AN INFORMED DECISION TO COMMENCE, IN THE EARLY 1990s, ENGINEERING DEVELOPMENT OF A SYSTEM CAPABLE OF DEFENDING THE US AND ITS ALLIES AGAINST ATTACK BY NUCLEAR-ARMED BALLISTIC MISSILES.

APPROACH:

- CONFIGURE A MULTI-LAYER CONCEPT THAT FORGIVES IMPERFECTION IN COMPONENTS.
- CONDUCT PARALLEL TECHNOLOGY DEVELOPMENTS ON ALL KEY COMPONENTS.
- DEMONSTRATE THE COMPONENTS WORK.

CURRENT ASSESSMENT:

- FOCUSED TECHNOLOGY DEVELOPMENT FOR MULTI-LAYERED DEFENSE LIKELY TO PROVE SUCCESSFUL.
- INTERMEDIATE DEFENSE CAPABILITIES, WHICH ARE PORTIONS OF THE ULTIMATE SYSTEM, POSSIBLE IN 1994-5.

2726-4

[Questions with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR JOHN W. WARNER, ANSWERS SUPPLIED BY MR. JOHN L. GARDNER, DIRECTOR, DEFENSIVE SYSTEM

SDI FUND REDUCTION IMPACT

Senator WARNER. If only modest levels of real growth were provided in FY85 to fund activities related to the Strategic Defense Initiative, what effect would a reduction of that magnitude have on the program you have proposed?

Mr. GARDNER. The objective of the SDI research and technology program is to develop and demonstrate relevant technology sufficiently to permit an informed decision to commence, in the early 1990s, engineering development of a system capable of defending the U.S. and its allies against attack by ballistic missiles. Reductions in the planned SDI funding levels would:

1. Delay the demonstration of technologies suitable for a U.S. defense system against nuclear ballistic missiles.
2. Put the U.S. even further behind the pace of the Soviet BMD program.

ROLE OF SERVICES IN SDI

Senator WARNER. Can you expand on Dr. DeLauer's statement regarding Department of Defense management of the five technical areas? What will be the role of the Services and Defense Agencies?

Mr. GARDNER. The DOD has combined into a single Strategic Defense Initiative (SDI) previously planned research and development programs in five technology areas: surveillance, acquisition, tracking, and kill assessment; directed energy weapons; kinetic energy weapons; systems analysis and battle management; and support programs including survivability, lethality, and hardening. To coordinate all these efforts, a centralized management office within the DOD has been established. The Program Manager will report directly to the Secretary of Defense and will hold frequent reviews to assess progress and to make decisions concerning the future direction of the SDI. The Program Office will utilize the expertise and capabilities of the Services, Defense Agencies, and other governmental departments for the accomplishment of the SDI program.

POTENTIAL FOR ACCELERATION

Senator WARNER. What is the potential for accelerating the date by which a system development decision could be made?

Mr. GARDNER. Defensive technologies are not sufficiently mature or understood to permit us to take near-term advantage of them or to fully assess their promise. The SDI, through a focused research program, seeks to establish the technical feasibility of defensive systems. The SDI program is now laid out to reach a system deployment decision in the 1990 time frame. The technology-limited pace established by the Fletcher Study called for $2.6 billion in fiscal year 1985. Currently we have requested $2.0 billion according to a plan submitted to Congress for fiscal year 1985. The technology-limited pace recommended by the Fletcher Study might accelerate this system development decision by 6–12 months.

STRATEGIC DEFENSE INITIATIVE

Senator WARNER. The Fletcher Panel recommended that we develop and preserve options for early deployment of a limited system should the threat justify such actions. Could you comment on the most promising early deployment options contained in the current program?

Mr. GARDNER. Obviously, the most promising deployment options are those with the most mature technology base. The focus in recent years on non-nuclear terminal interceptors and associated surveillance makes them an obvious candidate for early deployment after some development work to fit them to "the new mission" (high endoatmospheric non-nuclear intercept). Non-nuclear, midcourse interceptors are another candidate for early deployment in the current program. Boost phase technology, while least mature, could also offer promising options based on kinetic energy kill technology or the most mature of the directed energy weapons technologies.

Senator WARNER. In the recent past there has been considerable debate about the relative funding priority given to chemical lasers over short wavelength lasers. How has this been resolved in the proposed program?

Mr. GARDNER. The overall flow of the program is focused by an approach in which both concepts converge at an early 1990's decision point on whether to initiate system level validation demonstrations. This does not mean that equivalent levels of technical maturity will have been reached or that the technical risks in proceeding will be similar. However, the data base developed by that time is expected to support assessments on effectiveness, cost, and readiness needed for such a decision on both chemical and short wavelength lasers.

Senator WARNER. How does the proposed program affect our ability to field an interim ballistic missile defense system in the next decade?

Mr. GARDNER. The Strategic Defensive Initiative (SDI) progam provides for research and development of both the nearer term and longer term technologies. The investment to be made in the nearer term technologies is substantial and the program calls for an integrated demonstration [Deleted.] A decision to deploy has not been made. [Deleted.]

Senator WARNER. Recognizing that we will be addressing this issue in greater detail in the near future, could you comment briefly on your preliminary findings on the survivability of space-based assets?

Mr. GARDNER. Space-based assets must be able to withstand potential attacks from other defensive systems. We believe that a combination of tactics and technology, such as maneuvering, deception, jamming, shielding, spacing, and "shoot-back," could provide the necessary degree of survivability. While it is always possible to attack and destroy a single component with a concerted effort, the cost of doing so can be so prohibitive that an opponent will not attempt it. This situation is no different from any other military system, such as a ship or an airplane. The airplane has gone through a transition from a fragile, surveillance platform to a survivable, war-fighting machine over the last several decades. It is expected that satellite systems will undergo an analogous evolution to survivable, military machines in space.

### CONSTRAINTS ON SDI

Senator WARNER. The Fletcher Study described two possible programmatic options to implement the President's guidance; the first of which was funding constrained, the other being technology constrained. In which category does the current Strategic Defense Initiative fit?

Mr. GARDNER. In fiscal year 1985 the technology constrained program was $2.6 billion. The fiscally constrained program was approximately $2.0 billion. Since the current request is for $1.98 billion for both DOD and DOE, it is a very close approximation to the fiscally constrained level of funding.

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## QUESTIONS SUBMITTED BY SENATOR STROM THURMOND, ANSWERS SUPPLIED BY MR. JOHN GARDNER, DIRECTOR, DEFENSIVE SYSTEMS

### SOVIET ABM BREAKOUT AND DETERRENCE

Senator THURMOND. What happens to deterrence and crisis stability if the Soviets break out of the Anti-Ballistic Missile Treaty and deploy a defensive system before we have one?

Mr. GARDNER. If the Soviet Union were to unilaterally develop and deploy an effective advanced defense against ballistic missiles, our ability to deter Soviet aggression against the United States and our allies would be reduced to a very low order.

### U.S. RESPONSE TO SOVIET LASER DEVELOPMENTS

Senator THURMOND. We have been briefed that the Soviets will be able to deploy laser weapons systems by the end of this decade. If they do so, what is our response to be?

Mr. GARDNER. We do not believe that the Soviets could deploy a laser weapon capable of effectively defending against ballistic missiles, by the end of this decade, although they could be in a position to exploit such technology as an ASAT weapon. The U.S. response must be to maintain an effective SDI program so as to ensure that at no time—either the end of this decade or the beginning of the 21st century—will the Soviets be in a position where they could exploit a technological lead over us to gain a significant military advantage.

Senator WARNER. The subcommittee is adjourned.

[Whereupon, at 12:25 p.m., the subcommittee adjourned, subject to the call of the Chair.]

APPENDIX A

# THE STRATEGIC DEFENSE INITIATIVE

## Defensive Technologies Study

MARCH 1984

THE UNDER SECRETARY OF DEFENSE

WASHINGTON D.C. 20301

RESEARCH AND
ENGINEERING

On March 23, 1983, President Reagan challenged the scientific community of the United States to investigate whether new technologies could provide the means for countering the awesome threat of nuclear ballistic missiles.

Following his historic speech, the President directed an intensive study to define the technologies necessary for defending the United States and our allies from ballistic missile attack. We collected over 50 of our nation's top scientists and engineers and asked them to assess the feasibility of achieving this goal and to structure a research program to develop the technologies that could provide an effective defense against ballistic missiles. This report summarizes the results of their effort, the Defensive Technologies Study.

The principal finding of the Defensive Technologies Study Team was that, despite the uncertainties, new technologies hold great promise for achieving the President's goal of eliminating the threat of ballistic missiles to ourselves and our allies. Based on the technical recommendations of this study the United States has structured a focused research and technology program of the highest priority to pursue these new technologies. This Strategic Defense Initiative will provide future Presidents with an option to enhance our deterrence capability by basing it on a mix of offensive and defensive forces. The Strategic Defense Initiative will have three aspects as its hallmark: innovation, focused technology programs, and technical demonstration milestones.

Our scientists and engineers are aware, like the President, that we face significant technical challenges and uncertainties. Yet, as we move into the next decade, I am confident that our greatest asset, our people's ingenuity and creativity, will make the President's vision a reality. We will pursue the Strategic Defense Initiative with utmost vigor. I believe that within the technologies reviewed by the Defensive Technologies Study are the seeds of a safer world. We owe it to ourselves, our allies, and most of all to our children to meet the President's challenge.

R. D. DeLauer

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In March 1983 President Reagan established as a long-term national goal an end to the threat of ballistic missiles. He said that "we must thoroughly examine every opportunity for reducing tensions and for introducing stability into the strategic calculus on both sides." He asked the scientific community to give the United States "the means of rendering" the ballistic missile threat "impotent and obsolete."

Shortly after his address to the Nation, the President directed that an intensive analysis be conducted, to include a Defensive Technologies Study to identify the most promising approaches to effective defense against ballistic missiles and to describe a technically feasible research and development program. A study team was formed and worked under the leadership of Dr. James C. Fletcher. This paper summarizes the team's report.

## SUMMARY AND CONCLUSIONS OF THE DEFENSIVE TECHNOLOGIES STUDY

The Defensive Technologies Study analyzed the technological feasibility of developing an effective defense against ballistic missiles and proposed programs in the areas of (1) surveillance, acquisition, and tracking; (2) directed energy weapons; (3) conventional weapons; (4) battle management, communications, and data processing; (5) systems concepts; and (6) countermeasures and tactics. Classified reports for each area and a Summary, Defense Technology Plan have been issued. Presented here is an unclassified overview of the summary report, with its principal findings.

The Study Team identified a long-term, technically feasible research and development plan. The goal of the study was to provide the basis for selecting the technology paths to follow when a specific defensive strategy is chosen. At the same time, near-term demonstrations of some system components were

identified that could provide options for early deployment and meaningful levels of effectiveness against constrained threats. The plan also incorporates ideas for enhancing the defense of NATO and other allies.

The study reviewed, evaluated, and placed priorities on the technological issues underlying the ballistic missile defense of the United States and its allies. Also reviewed was a set of strategic defense system concepts and supporting technologies in various states of development. In addition, the study considered system concepts where technological attributes were not preeminent, for example, concepts constrained by fiscal considerations. The study did not consider defenses against threats other than ballistic missiles, such as bombers and cruise missiles or conventional forces; these issues are dealt with in other Department of Defense studies.

The Defensive Technologies Study Team identified a research and development program to allow knowledgeable decisions on whether, several years from now, to begin an engineering validation phase that, in turn, could lead to an effective defensive capability in the 21st century. Similarly, intermediate deployments could be feasible that would provide meaningful levels of defense, especially against constrained threats.

The Defensive Technologies Study concluded that

- Powerful new technologies are becoming available that justify a major technology development effort offering future technical options to implement a defensive strategy

- Focused development of technologies for a comprehensive ballistic missile defense will require strong central management

- The most effective systems have multiple layers, or tiers

- Survivability of the system components is a critical issue whose resolution requires a combination of technologies and tactics that remain to be worked out

- Significant demonstrations of developing technologies for critical ballistic missile defense functions can be performed over the next 10 years that will provide visible evidence of progress in developing the technical capabilities required of an effective in-depth defense system.

## ADVANCES IN DEFENSIVE TECHNOLOGIES

The ballistic missile threat has increased significantly over the past 20 years, so an appropriate question is: "What has happened to justify another evaluation of ballistic missile defense as a basis for a major change in strategy?" Advances in defensive technologies warrant such a reevaluation.

Two decades ago there were no reliable approaches to the problem of boost-phase intercept; however, multiple approaches now exist based on directed energy concepts such as particle beams and lasers and kinetic-energy target destruction mechanisms.

Intercept in midcourse was difficult 20 years ago because of no credible concepts for decoy discrimination, the intercept cost, and the collateral effects of nuclear weapons used for the interceptor warheads. Today, multispectral sensing of discriminants with laser imaging and millimeter-wave radar, birth-to-death tracking, and direct-impact projectiles that

have promise as inexpensive interceptors appear to eliminate the difficulties of midcourse intercept.

In the 1960s an inability to discriminate penetration aids at high altitudes and limited interceptor performance resulted in very small defended areas for each terminal site and required an unacceptably high number of interceptors for effective defense. Now, technological advances may offer ways to discriminate among incoming objects and to allow intercepts at high altitudes. When these improvements are coupled with the potential for boost-phase and midcourse intercepts to disrupt pattern attacks, the effectiveness of terminal defenses is significantly increased.

Likewise, 1960s technology in computer hardware and software and signal processing was incapable of supporting battle management of the multitiered defense. Because of technological advances, the needed command, control, and communications facilities in all likelihood will be realized.

Several new technologies and concepts emerged from the work of the Defensive Technologies Study Team that, considered with those already well known, illustrate how far defensive technology has progressed over the past two decades. For example, throughout the phases of a ballistic missile trajectory, there are many observables, and by using both active and passive sensors, a selection of them can be measured. That is, it is likely that discrimination can be done between a warhead and a decoy or debris as threat objects proceed toward their targets. An active sensor works on the same principle as radar; a passive sensor relies on radiation emanating from the target. Some possible technologies the study identified for surveillance, acquisition, and tracking were active techniques such as thermal response of a target to a continuous-wave laser and passive

techniques such as imaging with infrared sensors. Although any one sensor can be defeated, it is very difficult to defeat several operating simultaneously.

The study also identified several concepts for the intercept and destruction of targets. Kinetic energy, or impact, devices include exoatmospheric and high endoatmospheric, nonnuclear, rocket-propelled projectiles and hypervelocity guns. Directed energy concepts with significant potential include ground- or space-based particle beams. Also identified were potential concepts for enhanced battle management and command, control, and communications as well as several different ways to ensure space systems survivability.

## THE THREAT

A variety of potential threats were considered, ranging from an attack with fewer than 100 ballistic missiles and a few hundred warheads to a simultaneous launch attack with more than 3,000 missiles and over 30,000 warheads. The Study Team selected a defense-in-depth approach because of the stress imposed by a maximum, unconstrained ballistic missile offense. The critical technologies highlighted later are best understood in the context of this threat.

## PROGRAM MANAGEMENT

The study concluded that a high priority should be placed on central management of the research and development program and there should be streamlined budgeting and contracting and effective security.

## THE BALLISTIC MISSILE DEFENSE ENVIRONMENT

The four phases of a typical ballistic missile trajectory are shown in Figure 1. First, there is a boost phase when the

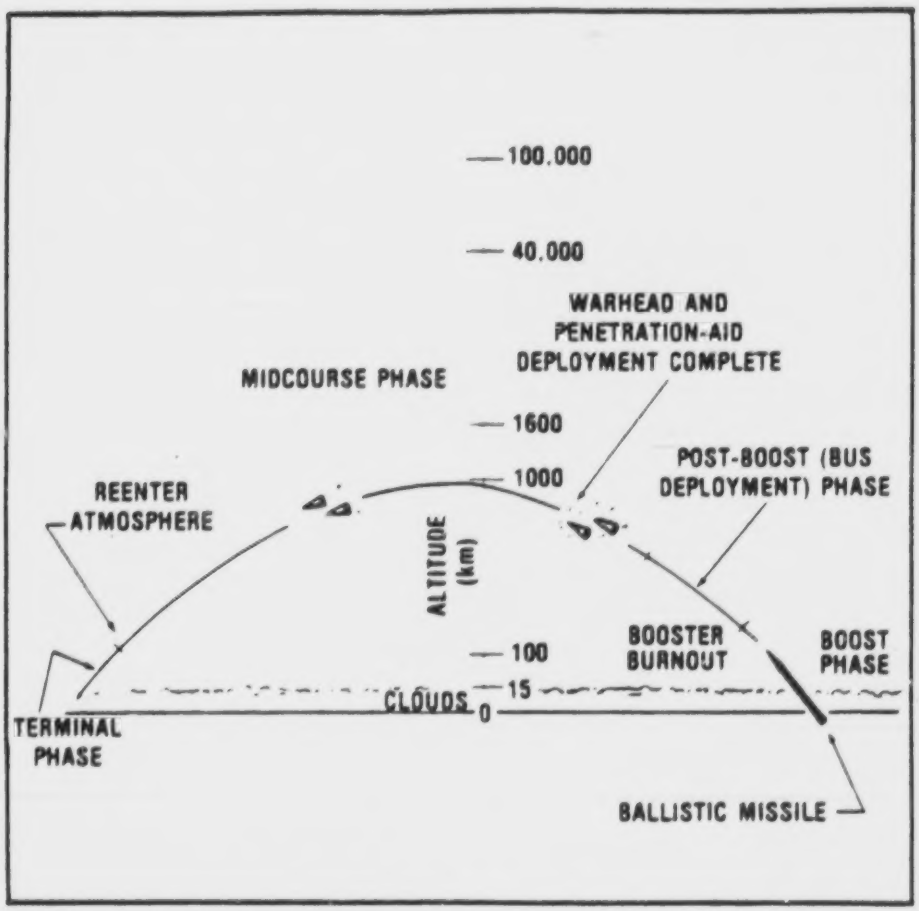


Figure 1: The phases of a typical ballistic missile trajectory. During the boost phase the rocket engines accelerate the missile payload through and out of the atmosphere and provide intense, highly specific observables. A post-boost, or bus deployment, phase occurs next, during which multiple warheads and penetration aids are released from a post-boost vehicle. In the midcourse phase the warheads and penetration aids travel on trajectories above the atmosphere, and they reenter it in terminal phase, where they are affected by atmospheric drag.

first- and second-stage engines are burning and offering intense, highly specific observables. A post-boost, or bus deployment, phase occurs next, during which multiple warheads and penetration aids are released from a post-boost vehicle. Then, there is a midcourse phase when warheads and penetration aids travel on ballistic trajectories above the atmosphere. Finally, there is a terminal phase in which the warheads and penetration aids reenter the atmosphere and are affected by atmospheric drag.

A ballistic missile defense capable of engaging the target all along its flight path must perform certain key functions:

- Rapid and reliable warning of an attack and initiation of the engagement. This requires global, full-time surveillance of ballistic missile launch areas to detect an attack and define its destination and intensity, to determine likely targeted areas, and to provide data for handoff to boost-phase intercept and post-boost vehicle tracking systems.

- Efficient intercept and destruction of the booster and post-boost vehicle. The defense must be capable of dealing with attacks ranging from a few tens of missiles to a massive, simultaneous launch. In attacking post-boost vehicles, the defense prefers to attack as early as possible to minimize the number of penetration aids deployed.

- Efficient discrimination through bulk filtering of lightweight penetration aids. The price to the offense in mass, volume, and investment for credible decoys should be high.



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- Enduring birth-to-death tracking of all threatening objects. This enables unambiguous handover, with few errors, of reentry vehicles to designated interceptors.

- Low-cost target intercept and destruction in midcourse. There should be recognition of the assigned target in the midst of a large array of penetration aids and debris. The cost to the defense for interceptors should be less than the cost to the offense for warheads.

- High endoatmospheric terminal intercept and destruction. This involves relatively short-range intercept of each reentering warhead.

- Battle management, communications, and data processing. These elements coordinate the system components for effectiveness and economy of force.

It is generally accepted, on the basis of many years of ballistic missile defense studies and associated experiments, that an efficient defense against a high-level threat would be a multitiered defense-in-depth requiring all the capabilities listed above. For each tier there will be leakage, that is, threat objects that have not been intercepted and hence move on to the next phase. For example, three tiers, each of which allows 10 percent leakage, yielding an overall leakage of 0.1 percent, are likely to be less costly than a single layer that is 99.9 percent effective. In addition, a multitiered defense is the optimum counter to structured attacks: any given offense response affects only one phase.

The defended area of a terminal-defense interceptor is determined, working backward in a ballistic missile trajectory,

by how fast the interceptor can fly and how early it can be launched. Terminal-defense interceptors fly within the atmosphere, and their velocity is limited. How early they can be launched depends on the requirements for discrimination of the target from penetration aids and accompanying debris. Because the terminal defense of a large area requires many interceptor launch sites, the defense is vulnerable to saturation tactics.

It is desirable, therefore, to complement the terminal defense with area defenses that intercept at long ranges. Such a complement is found in a system for exoatmospheric intercepts in the midcourse phase.

Intercept outside the atmosphere requires the defense to cope with decoys designed to attract interceptors and exhaust the defending force prematurely. Fortunately, available engagement times in midcourse are longer than in other phases. The midcourse defensive system must provide both early filtering, or discrimination, of nonthreat objects and continuing attrition of threat objects if the defense is to minimize the pressure on the terminal system. Intercept before midcourse is attractive because starting the defense at midcourse accepts the potential of a large increase in targets from multiple independently targeted reentry vehicle and decoy deployment.

The ability to respond effectively to an unconstrained threat is strongly dependent on the viability of a boost-phase intercept system. For every booster destroyed, the number of objects to be identified and sorted out by the remaining elements of a layered ballistic missile defense system is reduced significantly. Because each future booster could be capable of deploying tens of reentry vehicles and hundreds of decoys, the leverage, or the advantage gained by the defense,

may be 100 to 1 or more. A boost-phase system is itself constrained by the relatively short engagement times and the potentially large number of targets. Because of these constraints, an efficient surveillance and battle-management system is needed.

That phase of flight in which post-boost vehicle operations occur is a transition from boost phase to midcourse. In this phase the leverage gained by the defense decreases with time as decoys and reentry vehicles are deployed. On the other hand, the post-boost phase offers additional time for intercept by boost-phase weapons, and above all an opportunity to discriminate between warheads and deception objects as they are deployed.

The phenomenology and required technology for each of these phases of a ballistic missile trajectory are quite different. In each phase of a ballistic missile flight, a defensive system must perform the basic functions of (1) surveillance, acquisition, and tracking and (2) intercept and target destruction.

## SURVEILLANCE, ACQUISITION, AND TRACKING

Just as there are many tiers to the overall ballistic missile defense system, there can be more than one tier in each of the phases. These space-based surveillance, acquisition, and tracking components perform different tasks because the nature of a structured attack changes as the threat objects proceed along their trajectories. To illustrate this point and also to indicate how the components of one phase may interact with those of another phase, two potential technologies will be described -- (1) infrared sensors and laser designators for the midcourse phase and (2) infrared sensors and laser trackers for the terminal phase.

The surveillance, acquisition, and tracking function includes sensing information for battle management and processing

signals and data for discrimination of threatening reentry vehicles from other objects. As each potential reentry vehicle is released from its post-boost vehicle, it begins ballistic midcourse flight accompanied by deployment hardware and possibly by decoys. Each credible object must be accounted for in a birth-to-death track, even if the price is many decoy false alarms. Interceptor vehicles of the defense must also be tracked.

The midcourse sensors must be able to discriminate between the threatening reentry vehicles that have survived through the post-boost deployment phase and nonthreatening objects such as decoys and debris. They must also provide reentry vehicle position and trajectory data for firing interceptors and assessing target destruction. Most reentry vehicles must be recognized, even if again there are many false alarms. Requirements are to track all objects designated as reentry vehicles and other objects that may be confusing to later tiers.

Space-based, passive infrared sensors could provide a way to meet these requirements. They could permit long-range detection of cold bodies against the space background, rejection of simple lightweight objects, and birth-to-death tracking of designated objects. Laser trackers could provide imaging to determine if targets had been destroyed and precision tracking of objects as they continue through midcourse. As the objects proceed along their trajectories, data on them are handed off from sensor to sensor, and track files on threat objects are progressively improved.

The terminal phase is the final line of defense. The tasks of surveillance are to acquire and sort all objects that have leaked through early defense layers and to identify the remaining reentry vehicles. Such actions will, where possible, be based on handovers from the midcourse engagements. Objects

include reentry vehicles shot at but not destroyed, reentry vehicles never detected, and decoys and other objects that were neither discriminated nor destroyed. These credible objects must be handed off to terminal-phase interceptors.

An innovative concept for the terminal phase is the airborne optical adjunct -- a long-endurance platform that would be put into position on warning of attack -- that would detect arriving reentry vehicles using infrared sensors, as those space-based sensors had done in midcourse, tracking those that were not previously selected. The airborne sensors would also provide the data necessary for additional discrimination. They could acquire and track objects in late exoatmospheric flight and observe interactions with the atmosphere from the beginning of reentry. Then, a laser or radar would precisely measure the position of each object and refine its track just before committing the interceptors.

## INTERCEPT AND TARGET DESTRUCTION

A variety of mechanisms, including directed energy, can destroy a target at any point along its trajectory. The study identified several promising ones. An excimer laser, for example, can be configured to produce a single giant pulse that delivers a resulting shock wave to a target. The shock causes structural collapse. A continuous-wave or repetitively pulsed laser delivers radiant thermal energy to the target. Contact is maintained until a hole is burned through the target or the temperature of the entire target is raised to a damaging level. Examples included in this category are free-electron lasers, chemical lasers (hydrogen fluoride or deuterium fluoride), and repetitively pulsed excimer lasers. Another way to destroy a target is with a neutral-particle beam, which deposits sufficient energy within a target to destroy its internal components. Guns and missiles destroy their targets through kinetic-energy impact. Here, homing projectiles are propelled by chemical

rockets or by hypervelocity guns, such as the electromagnetic gun based on the idea of an open solenoid.

Figures 2, 3, and 4 show ballistic missile defense during terminal, midcourse, and boost phases.

## BATTLE MANAGEMENT

The purpose of battle management is to optimize the use of defense resources -- it is a data-processing and communication system that includes the command, control, and communication facilities. Its tasks are situation monitoring, resource accounting, resource allocation, and reporting.

A layered battle-management system would correspond to the different layers of the ballistic missile defense system, with each layer being semiautonomous with its own processing resources, rules of engagement, sensor inputs, and weapons. During an engagement, data would be handed over from one phase to the next. Its exact architecture would be highly dependent on the mix of sensors and weapons and the geographical scope of the defensive system that it manages.

Sensors survey the field of battle, and their raw data are filtered to reduce the volume. Later processes organize these data according to the size of the object; information specific enough to determine its orbital parameters and positions as a function of time; and a listing of other data that bear on the identity, classification, and threat status of the object being tracked. In principle, all objects in the field of view of the sensors are candidates, and all objects that cannot readily be rejected as nonthreatening will appear in the file, which is the representation of the total battle situation.

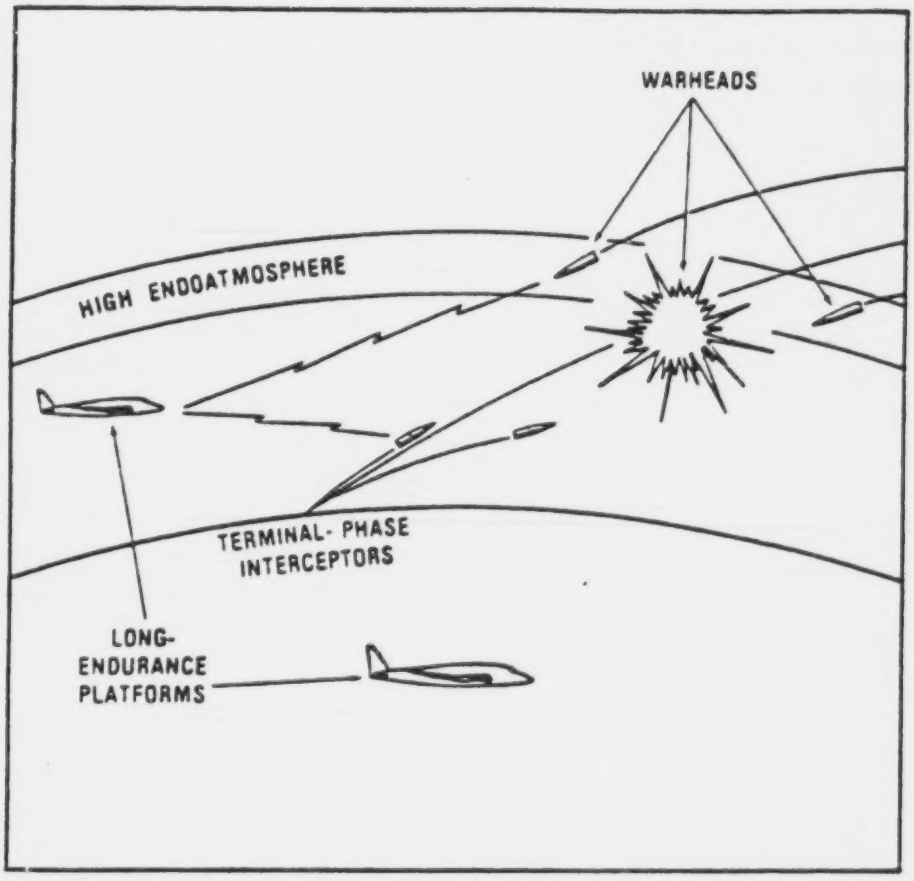



Figure 2: Strawman concept for ballistic missile defense during the terminal phase. This phase is the final line of defense. Threatening objects include warheads shot at but not destroyed, objects never detected, and decoys neither discriminated nor destroyed. These objects must be dealt with by terminal phase interceptors. An airborne optical adjunct is shown here. Reentry vehicles are detected in late exoatmospheric flight with sensors on these long-endurance platforms. The interceptors - nonnuclear, direct impact projectiles - are guided to the warheads that survived the engagements in previous phases.

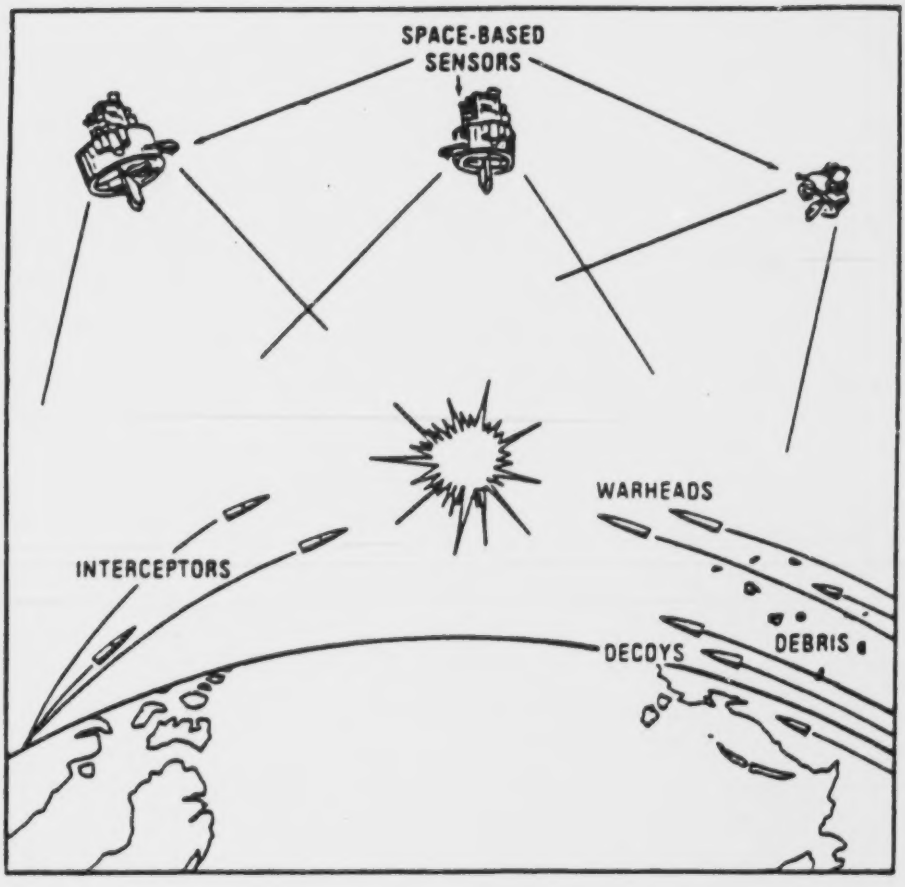



Figure 3: Strawman concept for ballistic missile defense during the midcourse phase. Intercept outside the atmosphere during the midcourse phase requires the defense to cope with decoys designed to attract interceptors and exhaust the force. Continuing discrimination of nonthreat objects and continuing attrition of reentry vehicles will reduce the pressure on the terminal phase system. Engagement times are longer here than in other phases. The figure shows space-based sensors that discriminate among the warheads, decoys, and debris and the interceptors that the defense has committed. The nonnuclear, direct impact projectiles speed toward warheads that the sensors have identified.

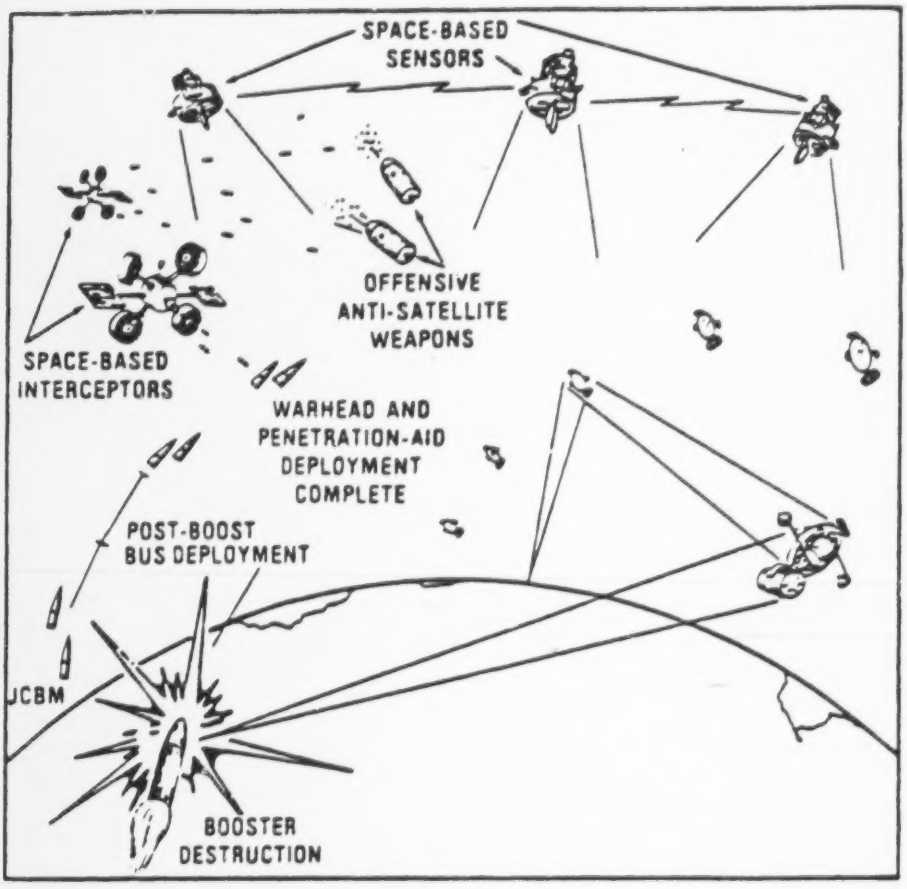



Figure 4: Strawman ballistic missile defense concept for boost-phase. An essential requirement is a global, full-time surveillance capability to detect an attack and define its destination and intensity, to determine targeted areas, and to provide data to boost-phase intercept weapons and post-boost vehicle tracking systems. Attacks may range from a few missiles to a massive, simultaneous launch. For every booster destroyed, the number of objects to be identified and sorted out by the remaining elements of a multitiered defense system will be reduced significantly. An early defensive response will minimize the numbers of deployed penetration aids. The transition (post-boost phase) from boost phase to midcourse allows additional time for intercept by boost-phase weapons and for discrimination between warheads and deception objects. Space-based sensors (three are shown at the top of the figure) detect and define the attack. Space-based interceptors (at the left in the figure) protect the sensors from offensive antisatellite weapons and, as a secondary mission, attack the missiles. In this depiction nonnuclear, direct impact projectiles are used against the offensive weapons.

The resources of the defense system include the sensors and weapons, the data-processing and communication gear, and the platforms or stations on which these and other components reside.

The allocation of defense system resources, both sensor and weapon, is a dynamic process that must be repeated with each significant change in the situation. Sensors must be assigned to sectors or to targets of interest at appropriate times to acquire necessary data, and weapons must be assigned to targets within a framework implemented by rules of engagement. An optimum allocation of resources involves extrapolating the present situation into the future and selecting a course of action that optimizes some quantity, for example, the number of targets destroyed. In each phase there are options available to the commander depending on the nature of the threat. The options also differ because events happen within different time frames.

Ultimately, data must be distributed to authorities external to the defense system to infer or sense the development of hostilities, to determine a defense condition level and take appropriate actions with respect to weapons release, to assist in inferring the attacker's intent, and to evaluate the effectiveness of the defense and anticipate damage.

Developing hardware will not be as difficult as developing appropriate software. Very large (order of 10 million lines of code) software that operates reliably, safely, and predictably will have to be deployed. Fault-tolerant, high-performance computing will be necessary. It must be maintenance-free for 10 years, radiation-hardened, able to withstand single-event upset, and designed to degrade gracefully. The main problem of network communication is managing networks of space-, air-, and ground-based resources. Other problems are real-time protocols

and dynamic reconfiguration. In addition, specific ballistic missile defense algorithms, for example, target assignment, as well as a simulation environment for evaluating architectures will have to be developed.

## SURVIVABILITY

Survivability is potentially a serious problem for the space-based components. The most likely threats to the components of a defense system are direct-ascent antisatellite weapons; ground- or air-based lasers; orbital antisatellites, both conventional and directed energy; space mines; and fragment clouds.

The approaches to enhancing survivability against a determined attacker are the classic ones that have been used to enhance the survivability of aircraft and surface ships: hardening, evasion, proliferation, deception, and active defense. Applying these functions in combinations will be necessary to counter the spectrum of potential attacks.

Ideally, the defense system should be designed to withstand an attack meant to saturate the system, that is, to survive an attack requiring the commitment of all defense system resources.

## OFFENSIVE RESPONSES

In all considerations of offense versus defense, there is a continuing dynamic interaction. Each action can stimulate a countermeasure. In response to the development of a ballistic missile defense system, history indicates that a potential opponent will, in general, proceed in a straightforward manner with the lowest level of countering technology judged adequate. There would be continual work on possible technical responses, and it

should be noted that each projected response involves a trade-off; for example, hardening of booster rockets means a reduced payload or range.

## CRITICAL TECHNOLOGIES

The Defensive Technologies Study Team concentrated on critical technologies, that is, the technologies basic to the longest lead-time items in a multitiered, four-phase ballistic missile defense system capable of defending against a massive and responsive threat. The concern was primarily with the technologies that are paramount -- the concepts whose feasibility will determine whether an effective defense is possible.

There are several critical technological issues that will probably require research programs of 10 to 20 years.

- Boost and post-boost phases. As mentioned earlier, the ability to effectively respond to an unconstrained threat is strongly dependent on meeting it appropriately during the boost and bus deployment, or post-boost, phases. This is especially important for a responsive threat.

- Threat clouds. Large threat clouds -- that is, dense concentrations of reentry vehicles, decoys, and debris in great numbers -- must be identified and sorted out during the midcourse phase and high reentry.

- Survivability. It will be necessary to develop a combination of tactics and mechanisms ensuring the survival of the system's space-based components.

- Interceptors. By having inexpensive interceptors in the midcourse phase and in early reentry, intercept

can be economical enough to permit attacks on threat objects that cannot be discriminated.

- Battle Management. Tools are needed for developing battle-management software.

The study also identified 5- to 10-year research programs dealing with other issues. One category is space logistics. In order of priority within this category, it is desirable to have (1) a heavy-lift launch vehicle for space-based platforms of up to 100 metric tons, (2) a capability to service the space components, (3) a capability to make available, on orbit, sufficient materials for space-component shielding against attack, and (4) an ability to transfer items from one orbit to another. In addition to these items, multimegawatt power sources for space applications would be required.

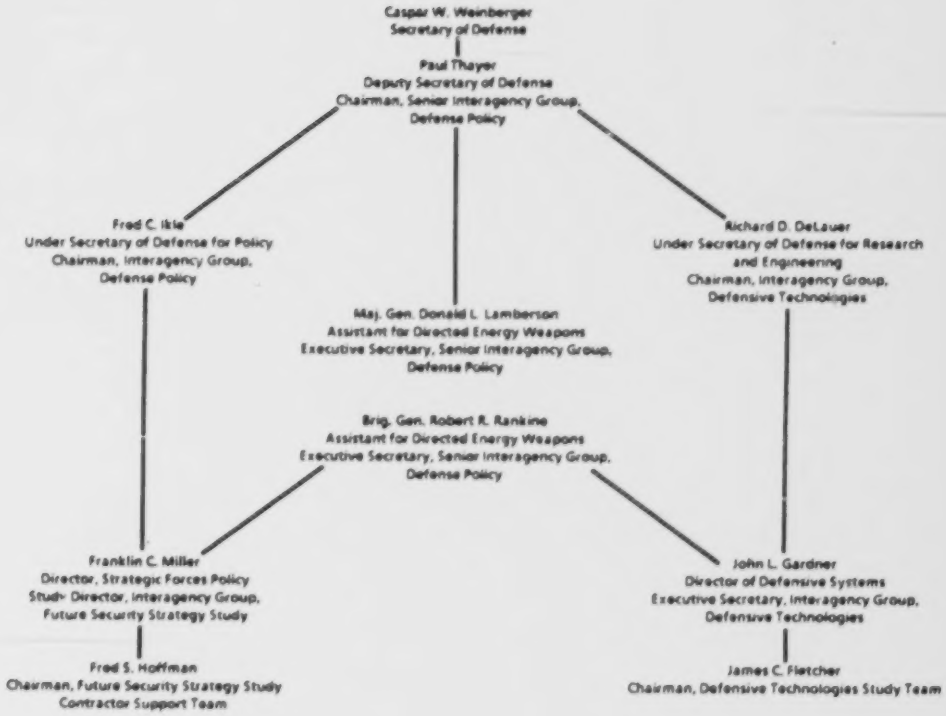
## NEAR-TERM DEMONSTRATIONS AND DEPLOYMENTS

An informed decision on system development cannot be made before the end of the decade, but there may be reasons for near-term feasibility demonstrations that could be developed into elements of a total ballistic missile defense system. Unlike the boost and post-boost phases, the trade-offs between competing technological approaches for the midcourse and terminal phases are relatively well understood. Although we cannot yet pick detailed designs for the major components of the midcourse and terminal-phase defenses, the best generic approaches are known and the set of competing technologies is narrow. A number of near-term demonstrations could be done before the end of the decade that typify technological milestones. Such demonstrations could include, among others, a space-based acquisition, tracking, and pointing experiment; a megawatt-class, visible-light, ground-based laser demonstration; an airborne optical adjunct demonstration; and a high-speed, endoatmospheric, nonnuclear interceptor missile demonstration.

In the next five years there are decision points that will affect the technologies available by 1990. Between 1990 and 2000 the United States may decide to provide increasing protection for its allies and itself by deploying portions of the complete four-phase system. Such deployments might be evolutionary, leading to the final, low-leakage system.

The members of the Defensive Technologies Study Team finished their work with a sense of optimism. The technological challenges of a strategic defense initiative are great but not insurmountable. By pursuing the long-term, technically feasible research and development plan identified by the Study Team and presented in this report, the United States will reach that point where knowledgeable decisions concerning an engineering validation phase can be made with confidence. The scientific community may indeed give the United States "the means of rendering" the ballistic missile threat "impotent and obsolete."

## ORGANIZATION



DEFENSIVE TECHNOLOGIES STUDY TEAM MEMBERSHIP

Study Team Leadership

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| Dr. James C. Fletcher, Study Chairman | The University of Pittsburgh |
| Dr. Harold M. Agnew, Vice Chairman | General Atomic Technologies, Inc. |
| Major General John C. Toomay, Deputy Chairman | United States Air Force (Retired) |
| Dr. Alexander H. Flax, Deputy Chairman | Institute for Defense Analyses |
| Mr. John L. Gardner, Executive Secretary | Office of the Secretary of Defense |
| Major Simon P. Worden, Executive Military Assistant | Office of the Secretary of Defense |

Conventional Weapons Panel

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| Dr. Julian Davidson, Panel Chairman | Science Applications, Inc. |
| Dr. Delmar Bergen | Los Alamos National Laboratory |
| Mr. T. Jeff Coleman | Coleman Research, Inc. |
| Dr. Clarke DeJonge | Science Applications, Inc. |
| Dr. Joseph R. Mayersak | USAF Armament Division |
| Dr. Harry D. Fair | Defense Advanced Research Projects Agency |
| Dr. James Katechis | U.S. Army Ballistic Missile Defense Systems Command |
| Lt Col Peter E. Gleszer, Military Assistant | Headquarters, Department of the Army |
| Lt Col Miles Clements, Military Assistant | Headquarters, Department of the Army |

Systems Concepts Panel

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| Dr. Edward T. Gerry, Panel Chairman (Boost-Phase Systems) | W. J. Schafer Associates, Inc. |
| Dr. Wayne R. Winton, Panel Chairman (Midcourse Systems) | Sparta, Inc. |
| Mr. Charles R. Wieser, Panel Chairman (Terminal-Phase Systems) | Physical Dynamics, Inc. |
| Dr. J. E. Lowder | Sparta, Inc. |
| Dr. James R. Fisher | U.S. Army Ballistic Missile Defense Systems Command |
| Dr. Louis C. Marquet | Defense Advanced Research Projects Agency |



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Directed Energy Weapons Panel

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| Dr. Gerold Yonas, Panel Chairman | Sandia National Laboratories |
| Dr. J. Richard Airey | Science Applications, Inc. |
| Dr. Robert T. Andrews | Lawrence Livermore National Laboratory |
| Dr. Richard J. Briggs | Lawrence Livermore National Laboratory |
| Dr. Gregory H. Canavan | Los Alamos National Laboratory |
| Dr. Robert W. Selden | Los Alamos National Laboratory |
| Captain Richard J. Joseph | Defense Nuclear Agency |
| Dr. Petras Avizonis | USAF Weapons Laboratory |
| Dr. Joseph A. Mangano | Defense Advanced Research Projects Agency |
| Dr. Robert C. Sepucha | Defense Advanced Research Projects Agency |
| Captain Alan Evans, Military Assistant | USAF Systems Command |

Systems Integration Panel

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| Lieutenant General Kenneth B. Cooper, Panel Chairman | United States Army (Retired) |
| Mr. Wallace D. Henderson | - Systems Planning Corporation |
| Mr. Robert T. Poppe | Braddock, Dunn and McDonald |
| Mr. John M. Rachkosky | General Research Corporation |
| | Office of the Secretary of Defense |

Surveillance, Acquisition, Tracking, and Kill Assessment Panel

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| Dr. John L. Allen, Panel Chairman | John Allen Associates, Inc. |
| Dr. George F. Aroyan | Hughes Aircraft Company |
| Dr. John A. Jamieson | John Jamieson, Inc. |
| Mr. William Z. Lemnios | Massachusetts Institute of Technology |
| Mr. Dennis P. Murray | Research and Development Associates |
| Mr. Robert G. Richards | Aerojet Electronics Systems |
| Mr. Fritz Steudel | Raytheon Corporation |
| Lt(jg) Patricia A. O'Rourke, Military Assistant | Office of the Chief of Naval Operations |

Countermeasures and Tactics Panel

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| Dr. Alexander H. Flax, Panel Chairman | Institute for Defense Analyses |
| Dr. Robert B. Barker | Lawrence Livermore National Laboratory |
| Dr. Robert G. Clem | Sandia National Laboratories |

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| Dr. Walter R. Sooy | Lawrence Livermore National Laboratory |
| Dr. James W. Somers | Defense Nuclear Agency |

Battle Management, $C^3$, and Data Processing Panel

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| Dr. Brockway McMillan, Panel Chairman | Private Consultant |
| Dr. Duane A. Adams | Private Consultant |
| Dr. Harry I. Davis | Private Consultant |
| Mr. J. R. Logie | Private Consultant |
| Dr. Robert E. Nicholls | Massachusetts Institute of Technology/Lincoln Laboratory |
| Mr. Robert Yost | Science Applications, Inc. |

Executive Scientific Review Group

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| Lt Col Michael Havey, | Office of Science and Technology Policy |
| Dr. Solomon J. Buchsbaum | Bell Laboratories |
| Mr. Daniel Fink | Private Consultant |
| Mr. Bert Fowler | Mitre Corporation |
| Dr. Eugene Fubini | Private Consultant |
| Admiral Bobby R. Inman | United States Navy (Retired) - Microelectronics and Computer Technology Corporation |
| Dr. Michael May | Lawrence Livermore National Laboratory |
| General E. C. Meyer | United States Army (Retired) |
| Professor William A. Nierenberg | Scripps Institute of Oceanography |
| Mr. David Packard | Hewlett Packard Company |

GLOSSARY

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| active sensor | A system that includes both a detector and a source of illumination. A camera with a flash attachment is an active sensor. |
| airborne optical adjunct | A set of sensors designed to detect, track, and discriminate an incoming warhead. The sensors are typically optical or infrared devices flown in an aircraft stationed above clouds. |
| algorithm | Rules for solving a problem using computer language. |
| architecture | The physical structure of a computer system, which can include both hardware and software (programs). |
| birth-to-death tracking | The ability to track a missile and its payload from launch until it is intercepted or reaches its target. |
| boost phase | The portion of a missile flight during which the payload is accelerated by the large rocket motors. For a multiple-stage rocket, boost phase involves all motor stages. |
| booster | The rocket that "boosts" the payload to accelerate it from the earth's surface into a ballistic trajectory, during which no additional force is applied to the payload. |

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| bus deployment phase | The portion of a missile flight during which multiple warheads are deployed on different paths to different targets (also referred to as the post-boost phase). The warheads on a single missile are carried on a platform or "bus" (also referred to as a post-boost vehicle), which has small rocket motors to move the bus slightly from its original path. |
| chemical laser | A laser in which chemical action is used to produce the pulses of coherent light. |
| coherent light | The state in which light waves are in phase over the time scale of interest. Light travels in discrete bundles of energy called photons. Each photon may be treated like an ocean wave. If all the waves are in phase, they are said to be coherent. When light is coherent, the effects of each photon build on top of the others. A laser produces coherent light and therefore can concentrate energy. |
| cold bodies | Objects at or near low ambient temperature, which radiate infrared radiation. All objects radiate electromagnetic energy, and if the object is hot enough, this energy is visible light. |
| constrained threat | A situation where opponents are limited in the number of warheads or types of missiles, for example, by arms control agreement. |

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| continuous-wave laser | A laser in which the coherent light is generated continuously rather than at fixed time intervals. |
| decoy | A device that is constructed to look and behave like a nuclear-weapon-carrying warhead, but which is far less costly, much less massive, and can be deployed in large numbers to complicate defenses. |
| directed energy | Energy in the form of particle or laser beams that can be sent long distances at nearly the speed of light. |
| discriminate | The process of observing a set of attacking objects and determining which are the real warheads and which are decoys and other nonthreatening objects. |
| dynamic reconfiguration | A means whereby a battle-management system can change its condition during a battle to respond to changing circumstances, such as the destruction of some defensive components. |
| electromagnetic gun | A gun based on the idea of an open solenoid. The projectile is accelerated by electromagnetic forces rather than by an explosion, as in a conventional gun. |
| endoatmospheric | When all activities take place within the earth's atmosphere, generally considered as occurring at altitudes below 100 kilometers. |

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| excimer laser | A chemical laser that uses noble gases. |
| exoatmospheric | When all activities take place outside the earth's atmosphere, generally considered as occurring at altitudes above 100 kilometers. |
| fragment clouds | Clusters of small objects placed in front of a target in space. This is a simple way to destroy the target. |
| free-electron laser | A laser in which electrons are converted to coherent light. The electrons are supplied by an accelerator and power for the laser by electrical energy. |
| hypervelocity gun | A gun that can accelerate projectiles to 5 kilometers per second or more, for example, an electromagnetic, or rail, gun. |
| imaging | The process of identifying an object by obtaining a high-quality image of it. |
| infrared sensor | A sensor to detect the infrared radiation from a cold body such as a missile reentry vehicle. |
| Interagency Groups | Two groups, one for Defensive Technologies and one for Defense Policy, set up to monitor the work of each study team. |
| intercept | The act of destroying a target. |
| kinetic energy | The energy from the momentum of an object. |

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| laser | A device for generating coherent visible or infrared light. |
| laser designator | The use of a low-power laser to illuminate a target so that a weapon equipped with a special tracker can home in on the designated target. |
| laser imaging | A new technology where a laser beam can be used in a way similar to a radar beam to produce a high-quality image of an object. |
| laser tracker | The process of using a laser to illuminate a target so that specialized sensors can detect the reflected laser light and track the target. |
| leakage | The percentage of warheads that get through a defensive system intact and operational. |
| midcourse phase | The long period of a warhead's flight to its target after it has been dispensed from the post-boost vehicle until it reenters the atmosphere over its target. |
| multispectral sensing | A method of using many different bands of the spectrum to sense a target, for example, visible and infrared light. If several bands are used, deceptive measures become much more difficult. |
| neutral-particle beam | An energetic beam of neutral atoms (no net electric charge). A particle accelerator moves the particle to nearly the speed of light. |

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| particle beam | A stream of atoms or subatomic particles (electrons, protons, or neutrons) accelerated to nearly the speed of light. |
| passive sensor | A sensor that only detects radiation naturally emitted (infrared radiation) or reflected (sunlight) from a target. |
| penetration aids | Methods to defeat defenses by camouflage, deception, decoys, and countermeasures. |
| post-boost vehicle | The portion of a rocket payload that carries the multiple warheads and has maneuvering capability to place each warhead on its final trajectory to a target (also referred to as a "bus"). |
| radiant energy | The energy from radiation such as electrons, protons, or alpha particles. |
| real-time protocols | Computer programs capable of making decisions as rapidly as input information is received. |
| repetitively pulsed laser | A laser that fires its beam in sequential short bursts, as opposed to a continuous beam or a single pulse. |
| Senior Interagency Group | Set up in response to the President's directive to study the ballistic missile defense problem. The group reported to the National Security Council and consisted of senior representatives from the Department of Defense, the Department of State, the Arms Control and Disarmament Agency, the |

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| | Central Intelligence Agency, the National Aeronautics and Space Administration, the National Security Council, and the Office of Science and Technology Policy. |
| signal processing | A computer system's capability to organize the raw data received from many different sources. |
| single-event upset | Electronic components of a battle-management system performing abnormally because of radiation. |
| structured attack | Timing the arrival of a sequence of warheads at their targets to create maximum destructive effects. |
| terminal phase | The final phase of a ballistic missile trajectory, during which warheads and penetration aids reenter the atmosphere. |
| threat clouds | Dense concentrations of both threatening and nonthreatening objects. The defense must distinguish between them. |

# DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 1985

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TUESDAY, APRIL 24, 1984

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC AND
THEATER NUCLEAR FORCES,
COMMITTEE ON ARMED SERVICES,
*Washington, DC.*

## STRATEGIC DEFENSE INITIATIVE

The subcommittee met in open session pursuant to notice, at 9:13 a.m., in room SR-222, Russell Senate Office Building, Senator John W. Warner (chairman) presiding.

Present: Senators Warner, Thurmond, Cohen, Wilson, Nunn, Exon, Levin, and Bingaman.

Staff present: James F. McGovern, staff director and chief counsel; Arnold L. Punaro, staff director for the minority; Alan R. Yuspeh, general counsel; Jeffrey H. Smith, minority counsel; Robert F. Bott, William E. Hoehn, Jr., George K. Johnson, Jr., professional staff members; Douglas R. Graham, research assistant; Karen A. Love, staff assistant.

Also present: Les Brownlee, assistant to Senator Warner; Robert Savitt, assistant to Senator Cohen; Jon Etherton, assistant to Senator Jepsen; Bernard R. Toon, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson; Jeffrey B. Subko, assistant to Senator Exon; and Edward McGaffigan, Jr., assistant to Senator Bingaman.

### OPENING STATEMENT BY SENATOR JOHN W. WARNER, CHAIRMAN

Senator WARNER. Senator Exon will be joining us momentarily.

The subcommittee convenes this morning to continue receiving testimony on the President's Strategic Defense Initiative from administration officials and public witnesses in review of S. 2414, the fiscal year 1985 Department of Defense authorization bill.

This hearing, in conjunction with earlier hearings before both the full Armed Services Committee and this subcommittee, will provide the record upon which we base our recommendations for this important strategic initiative.

For the first portion of today's hearing, I am pleased to welcome to his first appearance Lt. Gen. James A. Abrahamson, the recently named Director of the Strategic Defense Initiative.

General Abrahamson's most recent assignment was as the head of the Space Shuttle Program, and I would like to congratulate him on his new appointment.

General, you may commence by introducing your colleagues.

**STATEMENT OF LT. GEN. JAMES A. ABRAHAMSON, DIRECTOR, STRATEGIC DEFENSE INITIATIVE, ACCOMPANIED BY MAJ. GEN. ELVIN HEIBERG, U.S. ARMY, CHIEF, ARMY BALLISTIC MISSILE DEFENSE; BRIG. GEN. ROBERT RANKINE, U.S. AIR FORCE, ASSISTANT FOR DIRECTED ENERGY WEAPONS, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING, AND JOHN GARDNER, DIRECTOR OF DEFENSIVE SYSTEMS, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING, DEPARTMENT OF DEFENSE**

General ABRAHAMSON. Mr. Chairman, I am delighted to be here. I would like to introduce several of the people who have been very important to the Strategic Defense Initiative to this point.

General Heiberg on my left is head of the Army Ballistic Missile Defense Office and has been for some time.

General Bob Rankine of the Air Force has been leading the Strategic Defense Initiative activities in the Department of Defense for 7 months.

Mr. John Gardner has been very important in several of the areas, including surveillance and kinetic energy weapons.

If I might, I would like to read a short statement summarizing what I think are the principal issues that you have raised and then, of course, we will be very happy to answer some questions.

In a speech to the American people a year ago, President Reagan offered the hope of a world made safe from the threat of ballistic missiles. More specifically, he stated:

"Our ultimate goal * * * (is) eliminating the threat posed by strategic nuclear missiles," and "our only purpose * * * is to search for ways to reduce the danger of nuclear war."

President Reagan based this goal on recent technological advances which, he believes, offer us, for the first time in history, the opportunity to strengthen deterrence through effective defenses, rather than only through the threat of retaliation. He is determined that we exploit fully this opportunity. I am convinced he is right.

Secretary Weinberger recently selected me to be the program's director. I began acting in this capacity on April 16, and I am pleased to be here today to testify before this subcommittee.

At a hearing on March 8 before this committee, Dr. DeLauer presented a general overview of this initiative, including its purpose, the analysis and planning which was done following the President's speech of March 23, 1983, the funds we are requesting, and a summary description of the research and technology efforts we propose to pursue.

I wholeheartedly subscribe to the program as presented in that statement. Today I would like to address several specific issues which I understand are of special interest to this subcommittee.

We are frequently asked whether the purpose of the Strategic Defense Initiative (SDI) is to defend people or military forces. Accomplishment of both missions is essential to the ultimate goal, which is to provide security for the people of the United States and our allies.

The immediate objective is to conduct research on those technologies which might enable the development of defensive systems capable of intercepting ballistic missiles after they have been launched and preventing them from hitting their targets.

Once proven, these technologies could be used for the design and development of an appropriate system of defenses. The highly effective defenses that we envision have three attributes which, we believe, would contribute to the President's ultimate objective.

First and foremost, an effective defense against ballistic missiles would improve stability and reduce the likelihood of war by eliminating the military utility of a preemptive nuclear strike.

Second, in the unlikely event—whether planned or accidental—that nuclear weapons would be used in the face of effective ballistic missile and other defenses, such defenses would save lives and limit damage.

Third, by reducing the value of offensive nuclear forces, both military and economic incentives would be created for negotiated offensive force reductions.

I want to make a special point of the fact that our research is focusing on defenses against ballistic missiles of all ranges, including tactical and theater range systems as well as ICBM's and SLBM's. We are not seeking only to build defenses for the United States.

As Secretary Weinberger has indicated, our concept of an "effective" defense is one which protects our allies as well as the United States.

I must underscore Soviet efforts in the ballistic missile defense area. In data you have previously reviewed, the evidence of massive Soviet investments and programs is overwhelming. Were they to deploy the fruits of this program unilaterally, the consequences to our national security would be exceedingly grave.

However, a U.S. program capable of responding to Soviet deployments could lead to a safer world, with deterrence increasingly based on effective defenses for all sides.

Some have made the criticism that an effective defense against ballistic missiles is technologically unattainable, too expensive, and would only lead to another round of the arms race. We do not believe this to be true.

The members of the defense technologies study team (the Fletcher panel), a distinguished group of scientists, were initially very skeptical of the prospects for defensive systems.

However, after examining all of the relevant evidence, they concluded that "powerful new technologies are becoming available that justify a major technology development effort offering future technical options to implement a defensive strategy." They and we believe it will in fact be possible to construct an effective defense against ballistic missiles.

We do not believe that the Strategic Defense Initiative is the beginning of "another enormously expensive arms race," as some have asserted. Effective defensive systems could assist us in achieving the arms control goals of reduced ballistic missile forces and enhanced stability.

If defensive systems with sufficient effectiveness to enable the United States and the Soviet Union to decrease their dependence on offensive ballistic missile systems prove feasible, the security of both nations would be significantly enhanced at reduced levels of offensive arms.

While it is impossible at this relatively early date to render precise projections, overall, there is no reason to exceed the investment we have made in offensive forces in years past.

Furthermore, most people would probably agree that a defense which is capable of decreasing the likelihood of nuclear war would be worth a great deal.

The proper way for the United States to analyze its strategic investments is to consider how ballistic missile defenses, arms control, and modernized strategic offensive forces would each contribute to our national security, and, in particular, how they would complement each other.

Based on the President's direction, the DOD and the Department of Energy will develop the technologies in order to assess their abilities to support a shift toward a greater emphasis on defenses in our strategic posture.

Modernized, survivable offensive systems are required to maintain effective deterrence while the SDI research program is underway.

In the event the Nation decides in the future to deploy effective defenses, a capable offensive force will be important to maintaining deterrence and stability as we transition to an offense-defense force balance and new arms control regimes.

Therefore, the current modernization of our offensive capability is essential. However, effective defenses could obviate the need for major and costly offensive ballistic missile force modernization programs in the future.

As we proceed with our research program we intend to make each step add stability and decrease the risk of nuclear conflict. This can be accomplished only by pursuing arms control strategies in concert with our technology developments.

### NEED FOR FUNDING

There have been some expressions of concern about the amount of funding needed for the SDI. I would like to take this opportunity to clarify this issue.

Congress authorized and appropriated nearly $1 billion in fiscal year 1984 for technology which was subsequently determined to be relevant to defense against ballistic missiles.

Prior to the commencement of the Strategic Defense Initiative in response to the President's March 23, 1983 speech, the military services and defense agencies already had plans to increase spending for those relevant technologies to a little over $1.5 billion in fiscal year 1985.

That approximately 50 percent growth reflected service and agency recognition that these were the most promising technologies which should be emphasized within the otherwise prudently constrained growth of the overall DOD RDT&E budget.

Indeed, it was this very promise which led the Fletcher panel to conclude that effective ballistic missile defense was feasible. Among these high priority technologies were new sensors for advanced bal-

listic missile warning systems, space surveillance technology demonstrations, and nonnuclear ballistic missile interceptors, just to name a few.

The Fletcher panel identified the critical technologies necessary for effective ballistic missile defenses. A top priority issue for this group was survivability of space assets. When we reviewed our planned fiscal year 1985 program and compared it to the Fletcher recommendations, there were notable shortfalls in the funding planned for survivability and related lethality testing.

Within the overall fiscal constraints imposed on the DOD, it was considered imperative that we address this issue. We therefore requested a $250 million augmentation over our former plans for SDI-related technology development, most of it devoted to the urgent requirements in the survivability and lethality area.

I want to assure the committee that we fully understand the crucial nature of the survivability issue. Based on the technologies and techniques identified in the Fletcher report, we believe that space-based assets can be made survivable, even in the face of reactive threats.

The research program in that area will provide the additional information we need, both to ensure that space-based assets can be survivable, and to develop arms control proposals which will further enhance such survivability.

If you wish, we are prepared to address details of the survivability program later in executive session.

The President and the Secretary of Defense, recognizing the critical importance of this work, consider the entire SDI to be among the highest priority DOD efforts. The rather frightening story you have heard concerning Soviet space and missile threats underscores the importance of this effort.

The program that we have recommended to you is a balanced combination of technology demonstrations, including those described above, and basic technology development. These two components of the program are closely related.

Results of demonstrations guide technology development and new technological developments must be rapidly validated in experimental demonstrations. Reductions in our efforts which selectively slow either our demonstration program or technology development will have extremely adverse impacts on our balanced program to move the United States toward its ultimate goal of a thoroughly reliable defense.

### MANAGEMENT

The Fletcher report emphasized the importance of strong central management for the SDI. The Department of Defense is absolutely committed to this principle and I would like to outline how we are following this guidance.

We have established a Strategic Defense Initiative Organization to manage the SDI program. The Secretary of Defense intends that the Director will report directly to him. You have a signed copy of the charter that he signed this morning. The Director will have overall responsibility for managing the program and reporting on its progress.

In the next few weeks we will organize a highly centralized dedicated staff to proceed with this important effort.

We will also work to establish relationships with other agencies and organizations, both within and outside the Department of Defense. The senior interagency group-defense policy (SIG–DP) has overseen all efforts of the SDI to date.

This group, chaired by the Deputy Secretary of Defense and including senior representatives from all U.S. national security organizations, will continue to provide top level coordination and review of both our technology work and the political and military implications of strategic defense for the United States and its allies.

An SDI Executive Committee (Excom) consisting of the senior officers of the services, military departments, defense agencies, and components of the Office of the Secretary of Defense, and also chaired by the Deputy Secretary of Defense, has coordinated internal DOD efforts on the SDI.

The Excom will continue in this capacity. In order to execute the program we will establish, in consultation with the services and defense agencies, constructive relationships with those service and agency staffs.

The charter further authorizes the establishment of a special SDI Advisory Panel consisting of scientific, industrial, and academic experts who will assist us and provide important independent assessment of our plans and research efforts.

We will work with the Joint Chiefs of Staff and the Under Secretary of Defense for Policy in establishing mechanisms for assessing the strategy and policy implications of defensive capabilities.

We will also work closely with the Under Secretary of Defense for Research and Engineering to coordinate SDI programs with other related DOD programs to avoid duplication of effort. Since a significant portion of the SDI will be conducted by the Department of Energy, we have a formal memorandum of understanding now in coordination to cover that Department's SDI work.

To carry the SDI through the long term there are three fundamental authorities which the Director will have:

One. Establishment of streamlined channels of communication and direction with the service and agencies which will be conducting the work. Each service and agency will be asked to designate a single office of responsibility for its portion of the SDI. This will facilitate prompt response on the program.

Two. Responsibility to the Secretary of Defense for the SDI planning, programming and budgeting system.

Three. In consultation with the service and agency staffs, the Director will designate lead organizations, responsible for execution of the SDI projects and tasks. These projects and tasks have been centralized in five program elements which will be managed by the SDI staff.

We will initiate reprogrammings as required. We will seek class determination and findings authority for the SDI, as well as simplified procedures for rapid and creative means of achieving program objectives.

Senator COHEN. General Abrahamson, you mentioned that a number of different Departments have some responsibility in the SDI program. I note a number of House members have expressed concern that there seems to be no single area in the budget to which they can turn to find out how much money is being spent on this program.

Congressman Aspin, for example, pointed out in one of his statements that in addition to the $489 million for directed energy weapons in the SDI, in portions of the defense budget, there is another $404 million also for directed energy weapons.

Would you have any objections putting together one centralized portion of the budget that would specify to members of Congress exactly how much is being spent on research and development for these systems?

General ABRAHAMSON. Certainly, Senator Cohen. We will do that. We will provide that for the record.

## STRATEGIC DEFENSE INITIATIVE
## FY 1985 BUDGET

($ Millions)

| Major Technical Areas | FY 84 Appropriation in related areas | FY 85 Planned Prior to President's Speech | FY 85 SDI Budget | % real growth* from FY 84 | % growth from FY 85 prior plan |
|---|---|---|---|---|---|
| Surveillance, acquisition, tracking & kill assessment | 366.5 | 735.7 | 721 | 88 | −2 |
| Directed energy weapons | 322.5 | 369.1 | 489 | 45 | 32 |
| Kinetic energy weapons | 195.8 | 296.1 | 356 | 74 | 20 |
| System concepts, battle management, and $C^3$ | 82.7 | 89.5 | 99 | 14 | 11 |
| Survivability, lethality and subsystems | 23.5 | 36.6 | 112 | 355 | 206 |
| DOD TOTAL | 991.0 | 1527.0 | 1777 | 71 | 16 |
| Department of Energy | 116.0 | 210 | 210 | 73 | 0 |

* 4.7% Price Escalation from 1984 to 1985 for RDT&E TOA

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However, I would point out that we have within the DOD tried to centralize the entire program within these five program elements.

In addition to that, in the charter that you are now having available today, we have asked each of the services as they prepare their budget, to identify programs within the SDI that support other requirements and programs that are outside of the SDI that are important to the SDI progress.

So, we will be able to designate for everybody, I think, a much clearer picture as well as, of course, the DOE program.

Senator COHEN. In the central authorization budget you would not have any objection to having a separate title for the annual budget for SDI?

Senator ABRAHAMSON. I believe that what we have at this point in our request is five program elements that do accomplish that.

There are also some basic programs which are very important to the SDI, but are also important to many of the other requirements and some of those are not included in the SDI.

We will be happy to designate those for you.

[The information follows:]

STRATEGIC DEFENSE INITIATIVE

The technology programs which are principally relevant to defense against ballistic missiles have been collected under five new program elements (63220D, 63221D, 63222D, 63223D and 63224D) which will be under the central management of the Director, Strategic Defense Initiative Organization (Lt Gen James Abrahamson). These program elements are described in detail on pages 31 through 106 of the February 1984 "Justification of Estimates for Fiscal Year 1985 Submitted to Congress for Research, Development, Test and Evaluation by Defense Agencies and the Director of Test and Evaluation, Defense." This consolidated budget request for the Strategic Defense Initiative totals $1,777,000,000 in Fiscal Year 1985.

Two other categories of programs have been identified as important to the Strategic Defense Initiative. The first of these consists of programs which are wholly justified by requirements entirely distinct and separate from the Strategic Defense Initiative, but which provide collateral benefit to defense against ballistic missiles. The second category consists of general technology programs which benefit a broad range of military applications, including defense against ballistic missiles. It would be misleading to attribute these two categories of programs solely to the Strategic Defense Initiative. The programs in these two categories are listed below:

Category 1: Program Elements which are wholly justified by requirements entirely distinct and separate from the Strategic Defense Initiative, but which provide collateral benefit to defense against ballistic missiles.

Army:

| | |
|---|---|
| 63302A | Anti-Tactical Missile System. |
| 65301A | Kwajalein Missile Range. |

Navy:

| | |
|---|---|
| 61153N | Basic Research. |
| 62768N | Directed Energy Technology. |

Air Force:

| | |
|---|---|
| 62101F | Geophysics. |
| 63233F | Laser Hardening of Satellites. |
| 63424F | Missile Surveillance Phenomenology. |
| 63425F | Advanced Warning System. |
| 63428F | Space-Based Satellite Surveillance. |
| 63605F | Advanced Radiation Technology. |
| 12313F | Ballistic Missile TW/AA System. |
| 12423F | BMEWS Modernization. |
| 12431F | DSP Modernization. |
| 12432F | Pave Paws Upgrade/Expansion. |
| 33110F | DSCS Upgrades. |
| 33601F | AFSATCOM & MILSTAR Ground Terminals. |
| 33603F | MILSTAR Development. |

DARPA:

| | |
|---|---|
| 61101E | Basic Research. |
| 62301E | Strategic Technology (ST–2,7). |
| 62702E | Tactical Technology (TT–2). |
| 62707E | Space Power and Particle Beam Technology. |

DNA:

| | |
|---|---|
| 62715H | Vulnerability and Effects. |

Category 2: Program Elements providing general technology which benefits a broad range of military applications, including defense against ballistic missiles.

Army:

| | |
|---|---|
| 62105A | Materials. |
| 63314A | Air Defense HEL System. |
| 64307A | PATRIOT. |
| 23731A | SAM/HAWK Improvements. |

Navy:

| | |
|---|---|
| 61153N | Basic Research. |
| 62711N | Undersea Target Surveillance. |
| 62712N | Space Related Technology. |
| 62761N | Materials Technology. |
| 62762N | Electronic Devices Technology. |
| 63000N | New SSN. |
| 63202N | Avionics for Guidance. |
| 63318N | Advanced SAMs. |
| 63367N | Advanced Submarine ASW Standoff Weapon. |
| 63504N | Undersea Surveillance. |
| 63528N | Non-Acoustic ASW. |
| 63763N | Integrated Tactical Surveillance System. |
| 63784N | Fiber Optics Distributed Systems. |
| 63785N | Long Range Acoustic Propagation. |
| 63788N | Moored Surveillance System. |
| 64303N | AEGIS Area Air Defense. |
| 64307N | AEGIS Improvements. |
| 64314N | AMRAAM. |
| 64365N | SM–2 Target Detecting Device. |
| 64366N | Standard Missile Improvements. |
| 64503N | Submarine Sonar Development. |
| 64507N | Enhanced Modular Signal Processor. |
| 64524N | Submarine Enhanced Combat Systems. |
| 64577N | EHF Satellite Comm Terminals. |
| 64608N | IR Search & Track System. |
| 64610N | Advanced Lightweight Torpedo Development. |
| 64675N | MK–48 ADCAP ASW Torpedo. |
| 64725N | Relocatable OTH Radar. |
| 11224N | SSBN Security Program. |
| 11402N | Navy Strategic Communications. |
| 12427N | NAVSPASUR Modernization. |
| 24152N | E2C Early Warning Squadrons. |
| 24311N | Undersea Surveillance Upgrades. |

Air Force:

| | |
|---|---|
| 62102F | Materials. |
| 63211F | Aerospace Structures/Materials. |
| 63302F | Adv Msle Propulsion for Satellite Maneuverability. |
| 63401F | Space Vehicle Subsystems/Components Technology. |
| 63402F | STP Part of TEAL RUBY/P80. |
| 63406F | Adv Military Spaceflight Capability. |
| 63431F | Adv Space Communication Technology. |
| 63438F | Satellite Sys Survivability-Generic (SDS, TMGS). |
| 63452F | VHSIC. |
| 63715F | Unattended Radar. |
| 64314F | AMRAAM. |
| 64406F | ASAT System. |
| 64411F | Space Shuttle. |
| 64711F | System Survivability. |
| 12311F | Space Defense Operations Center Development. |
| 12325F | Joint Surveillance System (Min Attended Radars). |
| 12411F | Surveillance Radar Stations/Sites. |
| 12412F | DEWLINE. |
| 12417F | OTH Radar Development. |
| 12424F | Spacetrack Modernization. |
| 27130F | F–15 Squadrons. |
| 27133F | F–16 Squadrons. |
| 27417F | AWACS Upgrade. |
| 35110F | Satellite Control Facility Upgrades. |
| 35130F | Consolidated Space Operations Center. |
| 35171F | Space Launch Support Upgrade. |

DARPA:

| | |
|---|---|
| 61101E | Research. |
| 62301E | Strategic Technology (ST–4, 6, 9). |
| 62702E | Tactical Technology (TT–2). |
| 62708E | Distributed Information Systems. |
| 62711E | Strategic Technology. |
| 62712E | VLSI Technology (MPT–2). |

Senator WARNER. As a follow-on question, having had a little experience in the management of both those Departments, how do you keep those funds preserved for your purpose so that an ambitious secretary of a military department does not slip off and utilize them for another purpose before you get around to completing your planning and programming cycle?

Are you going to fence them?

General ABRAHAMSON. Yes, sir, we are.

Senator WARNER. Explain that fencing.

General ABRAHAMSON. The process which we have come to agreement on is one that we think will provide a fully fenced budget, but also will make the SDI program a responsible part of the overall national defense effort and obviously that means when there are problems, they will be examined and the Secretary of Defense will be the only one that will make final apportionment.

The way in which we go about that is that we will ask the services in the preparation of their budget and in the early cycles during the year, first of all, to estimate their programs, to rank them and to propose any initiatives in the area that they think are important, but they will only be able to keep those in line item that is the SDI line.

They will not be able to trade those off for other service needs. It is only at the Secretary of Defense's level that we will change that. You will see that line in the latter part of the charter, sir.

Senator WARNER. Have you finished your statement?

General ABRAHAMSON. Yes, sir, except for a conclusion.

Senator WARNER. Go ahead and finish and then I will address the committee.

General ABRAHAMSON. I think the most important aspect of our management structure is the availability of top-notch dedicated people. I am already singularly impressed with the people with whom I will be working, both within the Office of the Secretary of Defense and within the services and agencies. I have every reason for confidence that these people will meet the challenge the President has set.

CONCLUSION

In conclusion, I am pleased to have the opportunity to contribute to making the President's vision a reality. He has outlined a strategy of hope for people all over the world and for future generations. We need your help and commitment to undertake this noble challenge.

We are dedicated to a program that will provide our future leaders with options to enhance deterrence and stability by eliminating the threatening role that ballistic missiles play in our world.

The mere promise of such options may remove the pall of fear and anxiety that overshadows our young and provide them with the confidence that their future need not be dominated by the overriding fear of nuclear destruction.

Senator WARNER. General, that opening statement reflects a role of courageous leadership on your part.

We will now have the opportunity to ask questions. I would like to defer first to our colleague, Senator Cohen, who has a schedule conflict. Then we will ask each member hopefully to ask their questions within the period of 5 minutes.

It is the chair's desire to ask this panel to remain while we hear from the public officials and then we will go into closed session. I think that will provide a more coordinated approach to this hearing.

Senator COHEN. General Abrahamson, do you think we ought to withdraw from the ABM Treaty?

General ABRAHAMSON. No, sir, I don't. We are embarked on a research program which is allowed within the ABM Treaty. As we progress through that research program, I am sure that we will find that there will be things that will be in the U.S. interest and in the Soviet interest to modify as one proceeds.

At that point in time I think that we should enter into an arms control discussion with the Soviets. In fact, I think the key is that we cannot proceed with this program only in a technology mode and only in a technology research effort.

It is equally important that we develop and utilize an arms control strategy as we proceed.

Senator COHEN. In conducting the research and possibly developing strategic defensive systems, is it the purpose to force reductions in offensive systems?

General ABRAHAMSON. I think the President's vision is that eventually that is what we need to achieve.

Senator COHEN. In other words, if you could achieve the reduction in offensive systems without need for defense?

General ABRAHAMSON. If we were able to do that, that would be the final outcome, yes.

Senator COHEN. In other words, if we make progress, whether before this election or after this election, in reducing the numbers of ballistic missiles in our inventory and that of the Soviet Union, then embarking on so expensive a program would become unnecessary?

General ABRAHAMSON. I think, first of all, we do not to date have a very successful record in terms of achieving the kind of goal that the President really laid out for all of us, reductions in offensive nuclear weapons.

That goal is one that said that we would like to eliminate the threat and that is very different from moving in that direction. I am certainly not diminishing the valuable contribution that we would all achieve if we were able to in fact cut back and remove some weapons, but the real goal is the long term one of removing the threat as completely as possible.

Senator COHEN. Do we remove the threat by deploying a defensive system or remove the threat by negotiating reductions?

General ABRAHAMSON. I think it is probably both.

Senator COHEN. You anticipate that you will be required to deploy some of these strategic defensive systems?

General ABRAHAMSON. In an optimistic world, perhaps if all of our interests were aligned properly, meaning that our interest and the

Soviet Union's interest were clearly such that you could do that without deploying these things, then I think that would be the most desirable outcome.

I don't think history has proven that is a possibility.

Senator COHEN. I would like to turn to page 3 where you state:

"Modernized, survivable offensive systems are required to maintain effective deterrence while the SDI research program is underway."

As I understand it, the SDI could have an estimated IOC some time in the early nineties. Is that your understanding?

General ABRAHAMSON. We have not really tried to set up an estimated IOC. That terminology really refers primarily to a system that is well understood, that we can come to the Congress and present cost estimates and reasonable time estimates.

What we are embarked on now is a research program that hopefully will allow us to achieve that level of definition.

Senator COHEN. A number of statements have been made that we could achieve IOC, assuming enough resources are dedicated to it, within the early nineties.

Do you disagree with that?

General ABRAHAMSON. I don't disagree with it. What I am saying is that I can't give you a basis to say that that is a proper date.

Senator COHEN. You don't disagree with the statement that, given the level of technology today and given the resources, we could, in fact, achieve an IOC in the early nineties?

The second question I have is that we have IOC's of the MX of 1986, we have the IOC of the D–5 of 1989 or early nineties.

If you combine that capability of the D–5 and the MX with a very short time frame for having these strategic defensive systems, would that create a more stable or less stable world in your judgment?

General ABRAHAMSON. In the statement we tried to emphasize, in fact, a modernized offensive capability to manage a successful transition. The bottom line of the transition is that it must be one in which we at each step of the way find a way to reduce the risk in the world. Otherwise we can't go ahead with that.

Senator COHEN. If you have the MX and the D–5 and you have the SDI system, assuming you have those in these timeframes, do you anticipate reducing the ballistic missile force or maintaining them at the same level?

General ABRAHAMSON. I think at some point, and I don't know what that date will be, yes, sir, that is in the objective to reduce the offensive force structure itself.

General Rankine has reminded me that in fact the way we are approaching this overall research effort is that even though we don't know exactly when we would make it, people are looking ahead to a decision to enter full-scale development in the nineties.

That is quite different from an IOC as you indicated.

Senator COHEN. Would you say that having both the capability of the MX and D–5 plus the capability of the strategic defensive system creates a less stable or more stable situation?

General ABRAHAMSON. I think that any time we can add a carefully thought through defensive capability to our offensive capability, that indeed it will increase stability.

Senator COHEN. This is all I have, Mr. Chairman.

Senator WARNER. Thank you.

I would like to follow on with Senator Cohen's observation here.

In your prepared statement you stated:

> The proper way for the United States to analyze its strategic investments is to consider how ballistic missile defenses, arms control, and modernized strategic offensive forces would each contribute to our national security.

Therefore, I think you have now corrected an earlier statement that if we were successful in devising a means to reduce substantially the offensive forces, it would eliminate the necessity for this defensive system.

General ABRAHAMSON. That is my belief, sir.

Senator WARNER. I think the record will reflect that you came around full circle from an earlier statement. This Nation has proceeded on the concept of the triad since the inception of this nuclear capability and the current system possibly now embarked on is a "quadrad," if that is the correct Latin word.

This would be a fourth major system for the purpose of deterrence. These systems would be interdependent, would they not?

General ABRAHAMSON. Yes, sir.

Senator WARNER. Members of the committee, what I would like to recommend is that we have a period of questioning of 5 minutes each and then proceed with the public witnesses and ask this panel to return.

This would give the panel the advantage of profiting from the testimony proffered by the public.

Is that agreeable with the members present?

Thank you.

I recognize Senator Exon.

Senator EXON. Mr. Chairman, thank you very much.

General Abrahamson, welcome. We are looking forward to your closed testimony.

I congratulate the President in selecting you to head up this new Strategic Defense Initiative. I like your forthcoming manner and I think that you are going to find this committee very receptive to this fourth part of our overall deterrence, as the chairman has just said.

I would hope that in the public mind we could separate the Strategic Defense Initiative from ASAT. As I understand your responsibilities, you have no direct responsibilities as far as antisatellite systems are concerned, but your responsibility is in SDI, the Strategic Defense Initiative.

Do I assume correctly?

General ABRAHAMSON. That is correct, sir.

Senator EXON. Have you found some confusion in your studying the public perception of these?

They seem to get intermixed. I think it is critically important that we separate them.

Do you agree?

General ABRAHAMSON. Yes, sir, I do. I think that the ASAT issue is one that is upon us now. It is a matter for discussion and concern at this point in time whereas the SDI is a research program for the future.

Senator EXON. Thank you. That is well said. I think that point should be made.

There have been some questions about what parts of the budget the R&D for SDI is involved.

Can you give us any ballpark figures as of now as to what would be the total cost of this system, let us say, by the year 2000?

Do you have any estimate of that?

General ABRAHAMSON. Sir, we would like to be able to present you with that kind of estimate. The fact that we can't I think is because we are trying to be responsible. It is probably worthwhile to put where we are in this program in some perspective in that we are really embarked on a research effort.

The difference between this research effort and many of our efforts in our various laboratories is that we are trying to focus it in order to ensure that we have the most efficient path to a good solid end result.

Now, first of all, within the Department of Defense when we bring a program forward for definition as a program, we have a DSARC structure and we come up to a point in that which we call DSARC II. At that point we feel that we have sufficient definition that we can responsibly present a program to the Secretary of Defense and he can, in turn, responsibly present it to you.

We are nowhere near that at this point in time. Therefore, as much as I would like to be able to give you some true estimate, I don't think we can give you a responsible answer.

Senator EXON. I understand that. I am trying to put this in some ballpark figures. Let me say that I am convinced that we must move ahead on ASAT.

I am approaching the SDI with an open mind. It is a wholly new, frightening concept in the arms race similar to the time when the ICBM's first came in. I think this is a very dramatic advance. I hope we never have to deploy SDI, but we certainly have to plan for it.

Would it be safe to say from what you know now, looking into the future, that this would be well over $100 billion in the next 15 years? I mean just from the standpoint of reasonableness.

General ABRAHAMSON. From the standpoint of reasonableness, it could very well be in that category. I think perhaps the best perspective to maintain on this is that as we proceed through the development program and define portions of this, which indeed would be presented to the Congress for approval well before we would reach any strong commitment for proceeding, what will happen is that we will be staying within a general envelope which we might call a deterrence envelope.

In the past those expenditures have been for offensive forces.

In the future I think those expenses will be for the combination, the right combination, of offensive and defensive forces.

So, hopefully we will not exceed what the Nation has felt it can afford for deterrence. Now, that has been a fairly large number in the past, but we believe that as we go forward that we can keep it in that envelope. Now, that envelope has been recently on the order of 15 percent of the Defense Department budget.

Senator EXON. General, I think that most committee members would agree that there has been some conflicting testimony in front of this committee. Dr. DeLauer and Dr. Ikle I think essentially told us that

eliminating the threat posed by ballistic missiles was beyond the bounds of reasonable possibility.

However, this was contradicted by subsequent testimony by a series of administration witnesses led by Dr. Robert Cooper who insisted that the objective of SDI is nothing less than a leak-proof defense against ballistic missiles.

In starting out in this new world of space, do you believe that it will be possible to develop a leak-proof system and, if so, then we can look forward to the year 2000 where we will eliminate the triad altogether?

General ABRAHAMSON. I think the important thing is that the President has set us a vision and a goal that says let's try for this thoroughly reliable and effective defense.

It is kind of like our athletes this summer. I don't know any of our athletes this summer that are aiming to come in at 99.9 percent of the world's record. They are all aiming to come in to be first.

I think what the President has outlined for us is sort of like our Olympic athletes, that we should keep in mind a goal that says let's strive for an absolutely effective defense.

Now, what we are not able to do at this point in time is to define if that is a perfect defense or 99 percent, or whatever. But as we proceed through the research program, we will in fact make those judgments about what parts of one of these multilayered systems will allow us to make substantial gains toward that goal.

But it would be wrong to give up the goal so early in the process. Even if it is an unachievable goal, we ought to keep it in mind and strive for it.

Senator EXON. Well said, General.

I just simply say that as we launch on this R&D on this new system, a defensive system from our standpoint we must remember that it is as much offense as defense in the eyes of others.

Would you agree?

General ABRAHAMSON. No, sir; I don't think so.

I really feel that what a defensive system offers us is that it is not designed to kill people on the ground. It is designed to prevent killing and to save lives. I think that is the difference in terms of the definition of the difference between defense and offense in this case.

Senator EXON. My time is up, Mr. Chairman. I will explore this later.

Senator WARNER. We will have an opportunity, Senator, to question the witnesses later.

Senator Thurmond?

Senator THURMOND. Thank you very much, Mr. Chairman.

General, I have a number of questions here, but I have another committee meeting I have to go to. I will submit those for the record if you will be kind enough to answer them.

General ABRAHAMSON. Yes, sir.

Senator THURMOND. We appreciate your presence here and those who are with you. I just want to say that I strongly support your program.

General ABRAHAMSON. Thank you, sir.

[The questions submitted by Senator Thurmond follow:]

SDI AND NEW ARMS RACE

Senator THURMOND. General Abrahamson, critics claim that strategic defense will lead to a new arms race. Would you comment?

General ABRAHAMSON. The claim that strategic defense would lead to a new arms race might be true if effective defenses against ballistic missiles cannot be developed. However, what our research program seeks to do is to assess whether we *can* develop *effective* defenses—defenses capable of maintaining their capability against ballistic missile forces, *even if such forces were to be proliferated* substantially above current levels. If proliferation cannot restore offensive force effectiveness in the face of defenses, then incentives are created for reducing such forces.

STRATEGIC DEFENSE INITIATIVE

Senator THURMOND. How soon could we deploy a defense system to protect our ICBM fields if we fully funded the necessary technologies?

General ABRAHAMSON. Assuming the Strategic Defense Initiative research program demonstrates the promise of defensive technologies, and a national decision is made to base our deterrence posture on a balance of offensive and defensive forces, deployment of such defensive forces could begin in the 1990's. A sensible deployment of defenses, however should protect other strategic assets as well, not just ICBM fields.

Senator THURMOND. What level of cost would be necessary to fund a minimum system that would stabilize deterrence through increased survivability of strategic forces as opposed to a system that is designed to be very nearly "leakproof"? Such a system would be less comprehensive, but would increase the level of doubt about any advantage gained through a first strike.

General ABRAHAMSON. While the Strategic Defense Initiative will research and demonstrate the technologies that will provide options for defense of strategic offensive forces, it would be unrealistic to estimate the cost of a "minimum system" at this time. Cost estimates of any deployment would be largely dependent upon decisions which could only be made in the early 1990's when promising concepts had been selected (based on demonstrated technology), system level development defined and costed, and relevant strategies analyzed.

Nowhere has the administration stated that the goal of the Strategic Defense Initiative is to produce a "very nearly 'leakproof' defense." Rather, the goal is to research and demonstrate the technology for thoroughly reliable and effective strategic defenses that will improve stability and reduce the likelihood of war.

SDI TREATY AND SOVIET CHEATING

Senator THURMOND. General Abrahamson, we have obviously been hoodwinked in the Antiballistic Missile Treaty by Soviet cheating. What kind of arms control agreement regarding strategic defense could we enter into without finding ourselves at the mercy of the Soviets 10 years later because they cheat on that treaty also?

General ABRAHAMSON. One of the most important characteristics of effective arms control is verifiability. In the event of a national decision to proceed with the development and deployment of an effective defense against ballistic missiles, it will be important to engage the Soviet Union in discussions for the purpose of fashioning a mutual transition to a condition marked by increased dependence on defensive forces and decreased dependence on offensive forces. Treaty verifiability will be as important in a future defensive force environment as it is in today's offensive force environment and it is a characteristic we should insist be present in any future arms control agreements we might consummate with the Soviet Union.

SDI TREATY VERIFICATION

Senator THURMOND. How could such a treaty be verified when we cannot verify current cheating until it reaches advanced stages?

General ABRAHAMSON. While arms control measures can have serious verification flaws that can make the detection of cheating difficult, if not impossible, this need not be the case. Only those prohibitions for which compliance can be verified should be covered in such treaties and the means of verification should be sufficient to assure that any violations will not go undetected. However,

often the problem is not so much with adequate provision for verification, but with the willingness to enforce compliance when a clear violation has been detected. To prevent Soviet cheating in the future, therefore, not only will we have to develop verifiable treaties, but we also will have to be willing to enforce compliance in the event cheating is detected.

SOVIET BREAKOUT OF AN SDI TREATY

Senator THURMOND. What would be our response to a Soviet break of a possible "SDI Treaty"?

General ABRAHAMSON. It is impossible at this time to suggest a specific U.S. response to a hypothetical Soviet violation of an arms control treaty that might be adopted in conjunction with deployment of ballistic missile defenses. That response would depend on the specific nature of the violation. However, in general terms, any U.S. response should be such as to negate any advantage that might otherwise accrue to the Soviet Union as a result of the violation. We believe that carefully crafted and verifiable arms control treaties, in conjunction with a clear willingness to enforce compliance, will significantly reduce the possibility of Soviet violations.

Senator WARNER. Thank you, Senator Thurmond.

Senator Levin?

Senator LEVIN. Thank you, Mr. Chairman.

General, welcome.

General, assuming that our research and development proves that this system is workable, have we decided that we would deploy it?

General ABRAHAMSON. Pardon me? Would we decide?

Senator LEVIN. Have we decided, if this research and development program succeeds and we come up with a workable program, that we will deploy it?

General ABRAHAMSON. I think the accurate way to state that, sir, is that the President has given us a goal, but we are all reserving judgment for the deployment because, of course, that is a joint judgment between the executive and congressional branches of the Government.

Senator LEVIN. Has the President decided that he would want to deploy, assuming it is workable?

General ABRAHAMSON. I think what the President has done is given us a goal and we are marching out on the first step of that goal.

Senator LEVIN. Let me state the question again.

Assuming that the R&D program succeeds, has the administration decided it would seek to deploy it?

General ABRAHAMSON. I think it would be a logical thing to proceed in the deployment phase if we were successful. But the key is what we define success to be. I firmly believe that the program is not just a technology research effort.

If that were the case, frankly, it would be a much easier task than we are all embarked on.

In addition to the technology research, I think it is imperative we proceed hand in hand with an arms control strategy and a policy base so that indeed at each step of the way, which means when a deployment decision would be made for a portion of the system, that indeed we would be reducing risk as we proceed.

Now, that is not going to be easy. We will have to consider progress on the technical side along with the situation and what any one of these partial deployments might mean.

Senator LEVIN. I am not sure that that is a very clear answer, frankly.

We are embarking on what, a $25 billion R&D program?

General ABRAHAMSON. We have laid out over the 5-year period a program of that order of magnitude, yes, sir.

Senator LEVIN. We are embarking on a program and we either have decided or not decided at this point, assuming it is successful whether we will deploy it.

Have we or have we not decided?

General ABRAHAMSON. Again, I guess I feel that I have presented to the DSARC and to the Defense officials programs ranging from missiles to satellites that I said I thought we were ready with and I had to convince them that we were ready.

Senator WARNER. What does "ready" mean?

General ABRAHAMSON. Ready to deploy, sir.

Senator WARNER. If the Senator will yield, I have gone back over all this testimony and studied it in great detail. It seems to me the President would have to make the decision now to do the essential R&D.

I think we are on a slippery slope if we try to predict as to whether we will project a future President's determination whether to deploy or not.

It has been my understanding that this program from its inception was limited to R&D. There is no decision at this point in time with reference to any future deployment and that decision is reserved for another President early in the 1990's.

Senator LEVIN. Apparently the witness does not phrase it that way.

General ABRAHAMSON. I am sure I wasn't very articulate. What I was trying to say is that the President has given us a goal that will allow a President in the future to have a deployed system.

In order to do that, we have to start with research. I think that Senator Warner in fact explained it better than I in that the decision to deploy depends on not only the technical research, but also on the arms control strategy to ensure that as you reach a point where you can deploy, it will indeed mean that we can reduce the level of tension and reduce the risk in the world.

Senator LEVIN. Would you accept Senator Warner's formulation?

General ABRAHAMSON. Yes, sir, I would. It is much more articulate than mine.

Senator LEVIN. In other words, we have not decided we would deploy this system even if the R&D is successful. Is that correct?

General ABRAHAMSON. That is correct.

Senator LEVIN. So, we are embarked on R&D of a $25 billion magnitude without knowing that we would deploy the results even if we were successful. Is that correct?

General ABRAHAMSON. Yes, sir.

Senator LEVIN. Do you know any other system where we are spending that much on R&D where we don't know if we would deploy it even if the R&D were successful?

Can you give me any analogy to this?

General ABRAHAMSON. No, sir, I cannot, but I don't know any other system that has the hope of this particular system either.

Senator LEVIN. You did acknowledge, I believe, that the only way the system could be deployed, assuming again it were technologically possible, would be if the ABM Treaty were modified?

General ABRAHAMSON. Yes, sir.

Senator LEVIN. Would you agree that the only way the ABM Treaty could be modified would be with Soviet agreement that it be modified?

General ABRAHAMSON. Yes, sir.

Senator LEVIN. So, the only way we could deploy this system consistent with an ABM Treaty or its modification would be with Soviet concurrence?

General ABRAHAMSON. Exactly. That is why I indeed said that our problem is a two-pronged problem, not merely technical, but also to develop the proper strategy and policy base so that in fact it can go forward that way.

Senator LEVIN. Would you recommend that the only way this system be deployed would be if we could modify the ABM Treaty to accommodate it?

General ABRAHAMSON. I think that that is the only way that we can, yes, sir.

Senator LEVIN. My time is up.

Thank you, Mr. Chairman.

Senator WARNER. Senator Wilson?

Senator WILSON. Thank you, Mr. Chairman.

General Abrahamson, I am delighted with your appointment.

Let me ask your opinion of the program reductions of the House Armed Services Committee, which of these do you regard as having the greatest significance?

General ABRAHAMSON. I would like to make an overall comment and then I would like to ask Mr. Gardner and then General Rankine to add any comments they would like.

I think the first and most important point is that even before we define this research objective, all of the services quite independently laid out a program that was leading in this direction.

What we did is to sum up that program and we added to it; we filled in some of the shortfalls that were problems.

One of those, as I indicated, was survivability and lethality testing in order to be sure that we do have a viable concept. Therefore, the services were each voting in a sense for this technology well before the program was defined.

Now, what the House cut would do is in fact reduce things or reduce the pace of the program, now that it has been defined or a goal has been defined, below what was initially intended. I think that is just the wrong way to proceed on this important goal.

John, would you like to add to that?

Mr. GARDNER. Senator, as I am sure you realize, the House cuts were particularly severe in one of the program elements. That was the program element associated with surveillance, acquisition and tracking.

That particular program element was one that was planned to be expanded in a significant way prior to the President's speech. In fact, in that program element are the tasks associated with the development of technology for our advanced warning sensor systems as well as the technology for the development of surveillance of space assets that are also required to improve the survivability of satellite systems that we already have in the field.

It also is the area where we are doing the fundamental technical development of technologies for imaging sensors, for optical surveillance and tracking.

So, that particular program element is one that contains a significant number of items that have fairly broad applicability in this initiative as well as in other parts of our space program. So, I think the cuts there are particularly severe.

The cuts in some of the other areas are less of a problem. However, it is also true that the cuts in kinetic energy weapons do influence our ability to develop nonnuclear defensive interceptors which, of course, are one of the central thrusts that the program has been on and also was a thrust that was initiated prior to the President's speech.

Senator WILSON. Let me just ask what is the practical effect if the cut is sustained?

What would it do to the timetable?

Mr. GARDNER. It would extend the time when we could demonstrate these needed technologies. We have not made a complete assessment of just how long that time delay would be, but it certainly is within the period of 9 months to a year.

Senator WILSON. There have been a number of criticisms of the SDI program on the basis that it can be easily frustrated by cheap countermeasures.

General, do you believe there are easy and inexpensive countermeasures and would your R&D program address that particular point?

General ABRAHAMSON. First of all, I don't believe that there are easy measures that we can't, with a proper level of investment, overcome.

Now, there are some of our present systems that do not have countermeasures, therefore, it is possible to frustrate some of the present systems. But that is not the way in which we would build this system.

Yes, we should be proceeding with a very definite and aggressive approach to countermeasures and to survivability. The Fletcher report dealt very significantly with which of those we could implement and we think that it could be done.

Senator WILSON. Thank you, Mr. Chairman.

I would like to pursue this subject at greater length.

Senator WARNER. We will have further opportunity.

The Chair did not exhaust 5 minutes he has allocated to himself. I want to address one question.

I am concerned about your statement on page 1:

"We are frequently asked whether the purpose of the strategic defense initiative is to defend people or military forces."

I spent a good deal of time last week at SAC Headquarters over in Omaha with my colleague, Senator Exon. We probed this in several areas.

I am extremely doubtful that we are going to be able in the near future to make a determination whether this system has the capability of providing a defense for our population.

I am researching this "leakproof" statement. I am sure it is part of the record—it is not part of the President's determination—but the likelihood of a leakproof system, or at least contemplated at this time, in my judgment, solely a personal opinion, is not likely.

How do we intend to integrate this system with our planning on civil defense?

General ABRAHAMSON. I think that the planning for this system, at least the research for it, is completely separate at this point in time from any civil defense initiative.

Now, the civil defense initiative at some point in the future may in fact have a relationship, but one does not need to have a civil defense program in order to proceed with the research that tells you what kind of system you might be able to generate.

So, at this point there is no connection.

Senator WARNER. It is too early to really answer the question.

Senator Bingaman?

Senator BINGAMAN. Thank you, Mr. Chairman.

General, could I just ask regarding this program to spend $25 billion in the next 5 years and in light of Senator Exon's comment possibly a $100 billion in the next 20, would you support an effort to make the position that you have now been appointed to one that is subject to Senate confirmation?

General ABRAHAMSON. I believe, sir, that any lieutenant general assignment nomination is subject to Senate confirmation. In that sense, I believe it is the case.

Senator BINGAMAN. You don't think anything in addition would be appropriate, any kind of hearing on the qualifications of the person in charge of spending these billions of dollars?

General ABRAHAMSON. Sir, I don't believe any of us in the Department of Defense or I certainly would object to any discussion of that kind with you or any appropriate committee.

However, I think you do have the opportunity through just the fact that a high level military assignment must be in fact confirmed.

Senator BINGAMAN. Let me ask about a statement in the latest or the final, I guess, report issued by the President's Commission on Strategic Force, chaired by General Scowcroft. He said:

> The strategic implications of ballistic missile defense and criticality of the ABM Treaty to further arms control agreements dictate extreme caution in proceeding to engineering development in this sensitive area.

Do you agree with that?

General ABRAHAMSON. Yes, sir, I do.

Senator BINGAMAN. Senator Exon asked about the tie between this activity that you are engaged in here and anti-satellite weapons and arms control in that area.

I notice in your prepared statement you referred to the Fletcher panel and said top priority for this group was survivability of space assets.

Do you consider that it is crucial that to maintain that survivability we make progress in arms control on ASATs?

General ABRAHAMSON. I think it depends obviously on exactly what that arms control or what that ASAT Treaty is, its very specific nature and whether it is verifiable or not. I think that is really the key aspect.

In the President's report on the ASAT Treaty and going clear back to the policy that he stated in 1982 on the fourth landing of the shuttle, out at Edwards Air Force Base, by the way, he did indicate that he would pursue and consider the security involved or the increased security that an ASAT Treaty may well allow us.

However, I think the report emphasized that we have to have two criteria as we go ahead.

First of all, is it verifiable so that a treaty is more than just an agreement which doesn't mean anything in case of an emergency?

And second, how does it contribute to overall improvement in our security?

Since those are difficult items, as pointed out in the report on the ASAT Treaty, it really depends on the specifics. Therefore, I don't think there is a general answer to your question.

Senator BINGAMAN. Some of the critics of this SDI program have suggested that possibly the administration's opposition to going forward with ASAT arms control negotiations might be based upon their concern that any such arms control agreement might interfere with the development of these technologies in the SDI program.

Do you want to comment on that criticism? Is that one you have heard?

General ABRAHAMSON. Sir, I am not in a position to make any comment on it that would have any value.

Senator BINGAMAN. In one of the hearings that was held on this, Dr. Cooper of DARPA suggested that the most important part of the SDI funding was the 5 percent that was set aside for what he, I think, referred to as new and innovative technologies.

It was his testimony, as I recall it, that regardless of what other cuts are made in funding, that that 5 percent needed to be protected.

Would you agree with that?

General ABRAHAMSON. I would agree that it is important that we maintain a reserve that we can apply to innovative ideas.

However, to say that that is the single most important element of the whole program may be an overstatement. I think the important thing is that we must maintain a balanced research effort and that is one of the concerns with the cuts that have been laid out in the House.

That balance is one that we will be assessing constantly. It is one of the major activities that my centralized staff will be engaged in.

So, while I think it is important, I don't agree that it is the most important.

Senator BINGAMAN. What would be the most important?

General ABRAHAMSON. Again, I feel that we need the ability to have a planned and stable level of funding that we can then do two things with.

One is proceed on the longer term research efforts in such a way that they will bear fruit.

And second, that we can take advantage of shorter term opportunities and those shorter term opportunities are what Dr. Cooper, I believe, was really referring to.

That is important, but not singularly important.

Senator BINGAMAN. Thank you.

Is my time up, Mr. Chairman?

Senator WARNER. Yes, sir.

Senator Nunn?

Senator NUNN. Welcome to an important mission. You come with a solid reputation. I have felt for some time that this effort needed someone with a great deal of ability in charge of it. We look forward to working with you. We will ask tough questions and hope you will answer them.

On page 2 of your statement in your next to the last paragraph you have a sentence that I will read and ask for further explanation. You state:

If defensive systems with sufficient effectiveness to enable the United States and the Soviet Union to decrease their dependence on offensive ballistic missile systems prove feasible, the security of both nations could be significantly enhanced at reduced levels of offensive arms.

That has very, very profound assumptions built into it. Again:

If defensive systems with sufficient effectiveness to enable the United States and the Soviet Union to decrease their dependence on offensive ballistic missile systems prove feasible. . . .

That is a big "If". Can you conceive of the Soviet Union developing a defensive system and as they develop it over the next 10 years, we would reduce our offensive capabilities?

Can you conceive of that kind of situation?

You would come in and say to President Reagan, "Mr. President, the Soviets are getting so good on defense that they can shoot down so many of our missiles that I recommend we decrease our offensive effort"?

General ABRAHAMSON. I think that the overall equation that we are dealing with, sir, is the total amount of deterrence.

If it were clear that in fact we were not able to improve our deterrent level by proceeding with offensive systems and that we were better to shift to a more defensive structure, yes, I think that is exactly what we are saying at this point.

Senator NUNN. Do you mean to tell me if you get an intelligence assessment that says the Soviets can knock out 60 to 70 percent of our missiles coming in, your recommendation to the President would be then that we cut back on our offensive systems because they are increasingly ineffective?

I can't conceive of it. I am wondering if you can even intellectually conceive of that over the next 10 or 15 years?

General ABRAHAMSON. Sir, I think the important omissions in your statement, and perhaps it is assumed, is our own defense.

Senator NUNN. I am assuming we both are getting better defensive systems.

General ABRAHAMSON. I think whenever we find in any level of conflict that we have a weapon that is becoming less and less effective, then in fact we look to ways to either find more effective weapons or hopefully in an arms control atmosphere we can in fact have confidence in that we can say yes, we can keep the level of risk at a lower level by not investing further in offensive weapons.

Senator NUNN. I would agree with the statement you just made, but you had a very important statement.

You said, first of all, we would either find more effective systems—that means more offensive systems—or in a regime of arms control that we have confidence in, we could proceed to do less.

Now you are throwing in another assumption that we have an arms control regime in this whole equation that it seems to me, is important to explore.

You are saying that you would not be able to recommend decreasing our offensive systems in response to the Soviet and U.S. defensive systems unless it was within the context of an arms control regime?

General ABRAHAMSON. Sir, hopefully that is apparent in my whole statement that in fact an arms control effort and strategy is fundamental to everything as we proceed here.

Senator NUNN. Let me back up a minute and ask about the MPS system, multiple protective shelter system that was the MX basing mode.

Do you recall that?

General ABRAHAMSON. Yes, sir.

Senator NUNN. Do you recall the argument against that, is that the Soviets would proliferate warheads, their RV's, to the point that they could simply overwhelm that system?

General ABRAHAMSON. Yes, sir.

Senator NUNN. Do you recall that those who advocated that system acknowledged the validity of that overwhelming RV argument, and said it had to be in the context of an arms control regime?

General ABRAHAMSON. Yes, sir.

Senator NUNN. Limiting Soviet RV's.

General ABRAHAMSON. Yes, sir.

Senator NUNN. And those that advocated eliminating that system said basically we can't go for it because it requires us to rely on an arms control regime?

It seems to me we are right back in this whole situation to an analogy with the MPS system, that we are in fact developing a defensive system that is dependent on an arms control regime to be feasible.

General ABRAHAMSON. I understand the point you are making, sir.

Senator NUNN. Am I wrong in that?

General ABRAHAMSON. I think the key here is, and that is why it is so important, that the technology investigations emphasize a thoroughly reliable system because if you can't rely on the fact that you have an effective defense and that investment in the defense will in fact decrease the value of their offensive system, then I believe that indeed there is the potential of coming to an arms control agreement that is in the interest of both nations.

Senator NUNN. I think I see your point.

If I could have 1 more minute, Mr. Chairman. I think my time has probably expired?

Senator WARNER. Yes.

Senator NUNN. What assumption are you going to make about the number of RV's that this system would have to be able to handle?

Are you going to predict 30,000, 50,000, 100,000?

In other words, what are your basic assumptions on the Soviet RV offensive capability as you embark on this defensive effort?

General ABRAHAMSON. The Fletcher panel looked at an enhanced threat, one that has some three times the number of potential RV's that are presently there and presently available to the Soviet Union in any near-term increased projection.

They explored the possibilities of the technology, and remember that is what they were really looking at. They did look at something well beyond what the Soviet Union presently has deployed or, as well as we can tell, in their future growth planning.

Senator NUNN. Do you have a number?

General ABRAHAMSON. Yes, sir. They talked about some 30,000 as a potential.

Senator NUNN. Suppose they go to 60,000, what then?

General ABRAHAMSON. That is part of our research program again.

We have to understand the best way to in fact go after and ensure that we have a reliable defense.

Now, RV's are something that are difficult to control in an arms control regime. Therefore, one of the important elements that the Fletcher committee identified is different at this point in time than 20 years ago when we first talked about an ABM situation and finally abandoned it, is that it is now within the possibility, the realm of possibility, that we can in fact do boost phase intercept.

That is a very effective way of dealing with the Soviet offensive force.

Senator NUNN. You would agree for this defensive system to be effective in terms of overall stability in the long haul that we have to have it within the context of an arms control regime?

General ABRAHAMSON. Yes, sir, I would.

Senator NUNN. It would not be effective independent of that?

General ABRAHAMSON. I think the point is if we are able to proceed properly here, we will get both military and economic reasons for being able to negotiate a good solid arms control agreement.

Arms control is like law. The best law that I know we all have is the white line down the middle of the road where it is everybody's intent and in everybody's interest to stay on the right side of the road.

Senator NUNN. I wonder if we should not back up and try to go back to the MPS system which also depended on an arms control regime rather than spending $26 billion to get to the point that we can make a decision to spend $300 or $400 billion more and still depend on arms control for it to be feasible?

These are the points that we have to depend on an arms control element to make the system effective, otherwise it simply will not work.

I will explore that later. My time has expired.

Senator WARNER. That is all right. It is an important subject.

General ABRAHAMSON. General Rankine would like to comment on that.

General RANKINE. I think there is an important difference between the defenses and multiple protective shelter approach in that the defenses that the Fletcher panel envisioned, and now the administration is seeking, are defenses which would economically inhibit proliferation; whereas, that was not necessarily true with the multiple protective shelter.

If it were true that the Soviets would abandon the treaty limiting the number of warheads, perhaps on a cost-effective basis, you could proliferate warheads more cheaply than additional shelters.

Senator NUNN. You are talking about ballistic missile type RV's. You are not considering unconventional systems, bombs in basements or in cities that they could proliferate in an open society.

If I were a Soviet planner and I got to the point where I thought 99 percent of my offensive systems would be knocked down in terms of missiles, I would depend on other types of missiles that would be able to blow up targets in this country in an open society with nuclear weapons being able to be carried in small containers.

It seems to me what we would be doing is encouraging a great proliferation in another direction. I am just playing devil's advocate here. My question is:

What are you going to do to discourage the proliferation or discourage it in other areas than the ones that our ballistic defenses can cope with, assuming they work perfectly?

What are you going to do to keep a bomb from being in a basement in Washington, DC?

General ABRAHAMSON. Sir, at this point it is an appropriate question, but it is unanswerable. It is not a reason to not go after and try to defend against a very visible and terrible threat.

Senator NUNN. Are we down to an economic tradeoff? If I understand your argument, getting back to the economics of it, you are saying we may reach a point economically where our defensive systems are so good and can catch the launch phase of an offensive system, it would be cheaper for us to defend than for the Soviets to proliferate?

General RANKINE. That is right. That is the basis on which we would make the decision in the early nineties.

Senator NUNN. We have to spend $30 billion to get to that point to make the decision and the deployment of that system would cost $200 to $500 billion.

It seems to me you have a lot of front-end money before you get to that economic trade-off. You are talking about spending several hundred billion dollars of front-end money before we ever get there.

It seems to me that if you put the arithmetic to it, assuming the Soviets spent the same amount of money on defense, it would be parity there, but if they sat back and saved some dollars, they could spend $200, $300 or maybe $500 billion on offensive weapons systems before they got to the point of an economic dollar-for-dollar tradeoff.

General ABRAHAMSON. Sir, I would like to respond with two points.

First of all, we have all resisted just as much as we can, even though I know it is important, putting dollar signs associated with this because I think it is too early. We are including in the research and development effort a very important effort on ensuring that this is an affordable system.

That has to be part of the decision to go ahead. It can't be just technically feasible, but must also be affordable. Therefore, that is an inherent part of the research as we go ahead.

Senator NUNN. Your goal is to protect population and hard targets?

General ABRAHAMSON. The ultimate goal, yes, sir.

As I indicated, the goal is out there in the future. This does not mean we would not consider interim deployment because you will never deploy this as one huge system all of a sudden. That is not a practical way to proceed.

At each step of the way there will be an opportunity both for the administration and the Congress to evaluate interim deployments. Is this affordable at this level? Does it really offer us increased stability and indeed in that way move us in a step toward this ultimate goal that the President has laid out before us?

The first step will certainly not be an absolutely perfect defense, but the first steps should be ones that decrease the risk. That is why the ground rule that we discussed here is exceedingly important. We must consider both the research base which we have and the overall regime in terms of arms control and make a judgment, considering both of those and the policies that are there. Can we indeed take that step and really increase our level of safety in the world?

I believe that we can.

Senator NUNN. Thank you.

Senator WARNER. Senator Cohen, you indicated you wanted one followup.

Senator COHEN. You cited the Fletcher report.

Have you also read the Hoffman report?

General ABRAHAMSON. Yes, sir.

Senator COHEN. You recall on page 11 of that report it indicates that if we develop the new defensive systems and if they offer sufficient high level technology, that the Soviets might be persuaded to take a reduction in long-range offensive weapons.

The statement then says: "Their current program emphases suggest that they would be more likely to respond with a continuing build-up in their long-range offensive forces."

The question is: If that is our perception now, is it wise to spend these billions to get to that level only to say they are going to continue with their offensive system?

General ABRAHAMSON. I understand the point that is made there. It certainly is what a prudent military planner would look to as a first step.

On the other hand, if our research indicates that in fact some of the first stabilizing steps would in fact be useful to both sides and decrease risk, then a mutual decision to make these deployments would enhance our overall world situation.

Senator COHEN. What do you mean by stabilizing steps?

General ABRAHAMSON. First, we are in a research program to evaluate the practicality of that. I think we will have to keep that in mind. That is a first step.

The second step is before one begins to deploy any of these kinds of systems we do have to make a judgment, a judgment that it is affordable and that it really will decrease risk for that portion that we intend to deploy at that point in time.

Again, that will be a joint decision by some future President and some future Congress.

With that as a ground rule, that gives us a very difficult but worthwhile objective and one that I think is worth the kind of investment that we are talking about at this point in time.

Senator COHEN. Thank you.

Senator WARNER. Thank you very much.

Gentlemen, it is the chairman's recommendation that we ask this panel to remain and that we continue in open session to receive testimony of the following public witnesses——

Senator EXON. Mr. Chairman, let me make one statement, if I might.

I think it is very important to keep all this in perspective, gentlemen. I think you and I have had private conversations about this thing, we have to do some research and development, but what I was somewhat alarmed about with the President's speech a year ago in March was that I think it left the impression that somehow, somewhere if we work hard enough, there is that ultimate weapon, offensive or defensive, call it what you will.

I say while we have to do R&D on this, I think it should be clear to all if there is one thing we have learned, although we may not have learned it well, is that for every action there is a counteraction and cer-

tainly if we proceed in this area, the Soviet Union is not going to sit idly by. So, I guess while we must build up our defenses from a deterrent standpoint, I suggest that we never will find the ultimate weapon because whatever we do, the other side is going to take countermeasures.

That is just a concern I think we should remember.

General ABRAHAMSON. Sir, I understand that caution. I think it is a very appropriate perspective for all of us to keep in mind.

However, you did state it in the context of whatever action we take, they may take an action.

Senator WARNER. That is the point, General. Your observations are important that the Soviets have already taken the initiative in this area within the umbrella of the ABM Treaty and that, in fact, we have testimony in the record that it would require a decade of time before the United States could hopefully catch up to where they are now in their research and development.

Senator EXON. That is in ASAT.

Senator WARNER. No. That is in this program.

I read Dr. DeLauer's testimony last night and he made that statement in response to a question.

Senator NUNN. I think that is right. That is an important point.

The Soviets have very clear goals as to where they are going. I would question whether they have goals as broad as we have had here.

We have heard that we will protect populations with a leak-proof system, we are going to protect our allies. That means we are going to be able to go against not only ballistic missiles which will take many minutes to arrive, but artillery shells fired from 20 to 30 miles away. We are talking about a most complicated, complex, broad system.

We are also talking about a goal of basically abolishing offensive weapons, getting to the point where we are going to have a general go in and tell the President we have such a good defensive system that we now think we can abolish offensive weapons, or the alternative, the Soviets have such a good defensive system that we are going to advise that you slow down your production of offensive weapons.

I think it is enormously important, I can't judge the technology of this, but I can judge something about concept and goal and I think that is what we need to peg down. It is really what the goals are.

We have heard the goals, as I understand them, broadened today even far beyond what we have heard other technical witnesses say.

We are talking about protection against tactical nuclear attack, protection of population, we are talking about working toward elimination of offensive systems. That is some heck of a goal.

General ABRAHAMSON. No, sir. If that is the impression I gave, I am sorry, and I must correct it.

Senator NUNN. On page 2 of the statement you state: "Our research is focusing on defenses against ballistic missiles of all ranges, including tactical and theater range systems," and so forth.

General ABRAHAMSON. Tactical and theater range ballistic missiles, sir, not cannon-launched or other kinds of systems. We must, of course, draw——

Senator NUNN. Would it do any good to protect against ballistic missiles in Europe if the citizens are going to get knocked out with artillery tubes?

If you are going to do this, you have to have a comprehensive plan. If you don't have a comprehensive approach, you are going to encourage tremendous proliferation of systems that are not dependent——

Senator WARNER. We had better ask the witness to explain what he means by:

"As Secretary Weinberger has indicated, our concept of an 'effective' defense is one which protects our allies as well as the United States."

I read that to mean in the conventional wisdom of this whole strategic approach, the stronger we are strategically, it provides protection for our allies.

I did not infer it embraced tactical weapons in Europe.

General ABRAHAMSON. The intent again was to devise a system that will be an effective counter to nuclear ballistic missiles, not everything.

You just have to draw the line somewhere in terms of what we are trying to do. Remember this is a research effort, and the research for technologies associated with ballistic missiles that could attack our homeland may also have application to defending against nuclear ballistic missiles that could attack Europe.

Obviously, therefore, those technologies do have a relevance to that problem, but we are not trying to take on every possible offensive threat, no, sir.

Senator NUNN. Mr. Chairman, I was referring to the statement on page 2, the second paragraph. I think in fairness the General has said ballistic missiles of all ranges, including tactical and theater range systems.

Senator WARNER. That was ballistic systems.

Senator NUNN. What is a for instance in that, General? Is it the SS–20 you are talking about?

General ABRAHAMSON. Yes, sir.

General Heiberg, would you like to offer any discussion?

The Army has been embarked on a program in this area.

General HEIBERG. The Army part of the program would be looking mostly at the terminal layers, as we call them. There would be an applicability for both the U.S. systems and one that would provide defense against ballistic missiles in the European theater.

Senator NUNN. What kind of range are you talking about?

General HEIBERG. I will ask for help from Mr. Gardner who is better technically qualified on ranges, but we are talking, as General Abrahamson said, clearly about ballistic missiles because that is what we are discussing here.

Senator NUNN. What good will it do to protect against tactical ballistic missiles when you have artillery tubes that can fire from the same distances or slightly shorter distances and still have no defense against them?

General HEIBERG. What we are talking about is the ballistic missile aspect of the defense. These are longer ranges, these are certainly longer ranges than a cannon-fired projectile, but there is a good deal of efficacy, I think, in protecting those parts of Europe out of range of cannons.

We are talking about ballistic missiles.

Senator WARNER. General, is that a program which has been underway for some time?

General HEIBERG. The Army has been working on this program since the ABM Treaty.

Senator WARNER. It is not new. It is simply brought out in integration with General Abrahamson's new command, so to speak?

General HEIBERG. Yes, sir, it contributes to the program.

Senator NUNN. Would you be protected against the SS–21, for instance?

General ABRAHAMSON. The Fletcher report indicated that that might be possible. I think that it is premature to say that we know that that is the case.

The terminal kinds of defenses that one might develop, and remember again what we are doing is looking at a technology program and that technology may have broad applicability, clearly again for any theater range nuclear ballistic missile, the terminal system could, in fact, be used for that.

Now, whether or not you can get down to 100 miles, that may well be the case. Again, the Fletcher report indicated that it might be.

However, that is not well established at this point.

Senator EXON. Let me follow up on that.

General, you would agree, would you not, that if this defensive system was good enough to spot ICBM's immediately after launch, before they spewed off their RV's, it certainly is likely to be effective against cruise missiles, would it not?

General ABRAHAMSON. I think that has to be researched, sir. There is a hope that that kind of broader application might be there and certainly some parts of the system may well be able to contribute to a cruise missile or other kinds of threat defense.

Senator EXON. I am not an expert in this and you are, but if we could spot and destroy intercontinental missiles at the speed they travel, I think it would be relatively easy to spot and destroy the slower flying missiles.

Would that not seem logical?

General ABRAHAMSON. There are some differences in the acquisition problem, sir.

Ballistic missiles are propelled by a rocket. That means that we have a very intense energy source to look at that gives us a greatly improved ability to pick it up and focus on.

A cruise missile which is down in the background and operating with a more protected engine source may or may not be at this point detectable with the same technology.

That does not mean that there may not be improvement in that area. Again, I think it is too early to say that, yes, what we are developing here could indeed go effectively against cruise missiles.

Senator LEVIN. May I chime in with one question?

Senator WARNER. I will allow that. Then I hope we can proceed with the next panel.

Senator LEVIN. The Defense Minister of Germany was quoted as saying that this proposal threatened to destabilize East-West security and split the NATO alliance. That is a report about a week ago, I guess.

Have you commented on that?

General ABRAHAMSON. No, sir, I haven't to this point. I believe what Minister Woerner really said is that he expressed concerns of those kinds. Those concerns were picked up in that paper.

However, he did favor proceeding with the research program.

Senator LEVIN. At the same time he suggested that we precede that development with early talks with the Soviets.

Did he not couple that again with talks with the Soviets?

Are we talking with the Soviets on this issue?

General ABRAHAMSON. I can't comment on that part of it, sir.

Senator LEVIN. Whether these talks are underway or not?

General ABRAHAMSON. No, not in terms of what he specifically said.

Senator LEVIN. Are the talks underway with the Soviets relative to BMD?

General ABRAHAMSON. The answer is no, sir.

Senator LEVIN. Thank you.

Senator WARNER. Thank you very much.

We will now temporarily adjourn this panel and proceed to receive testimony from public witnesses.

Leading our witnesses will be Ambassador Gerard Smith, former Ambassador to the SALT negotiations. He will be joined by Dr. Donald Kerr, Director, Los Alamos Laboratory; Dr. Richard Garwin, IBM fellow, Thomas J. Watson Research Center; and Dr. Colin S. Gray, president, National Institute for Public Policy.

Mr. Ambassador, we welcome you. The Congress has had the privilege of receiving your testimony for many, many years on subjects relating to our strategic posture and that of our allies.

Will you kindly lead off for your panel.

## STATEMENT OF GERARD SMITH, FORMER AMBASSADOR TO THE SALT NEGOTIATIONS

Ambassador SMITH. Thank you, Mr. Chairman.

Last year President Reagan foreshadowed the development of radically new defensive weapon systems which would permit abandonment of a nuclear retaliatory threat which has been the core of our strategic military doctrine for some 35 years.

He called for systems that would render the Soviet ballistic missiles impotent and obsolete.

Incidentally, Mr. Chairman, I sometimes wonder what our reaction would have been to a similar statement from Mr. Andropov or Mr. Chernenko.

Now, the President expressly admitted that defenses, if paired with a continuation of offensive capabilities, would make for a dangerous mix. Yet everything I have heard here this morning suggests that is what we have in mind, to have a parallel defensive and offensive capability.

I am not competent to discuss the technical feasibility of what is now called the SDI, but having worked for more than 30 years on the international political aspects of nuclear weapons and their control, I am pleased to submit a few comments on the bearing of SDI on those specific aspects.

President Reagan has repeatedly said that nuclear war is unwinnable and must never be fought. Yet the SDI, as it seems presently to be evolving, looks very much like the damage limitation concept of the past.

Even though the President expressly stated that having both offensive and defensive would be dangerous, that seems at least the shorter term aim of SDI. We are told that it will, by offering protection to some of our strategic assets, strengthen the deterrent effect of the nuclear threat and if it comes to war, strategic defenses will limit the damage from a Soviet attack.

Now that the administration has accepted the illogic of deploying MX's in vulnerable silos, proponents of so-called hard point defense must see in the Strategic Defensive Initiative an answer to their concerns.

What was originally touted as a benign system to make all nuclear war unthinkable is likely to become just another effort to improve our retaliatory deterrent forces.

The ABM Treaty, which is the keystone of the arms control regime, cannot long survive if the SDI goes forward. This treaty was based on a common superpower recognition that mounting defenses against ballistic missiles would accelerate the offensive arms race, create a second race for defensive superiority and destabilize the existing strategic balance.

That conclusion remains entirely valid. It was not based on mere theory. The Soviet move of the late sixties to defend Moscow as well as concerns that their antiaircraft systems could be upgraded to have a potential against ballistic missiles triggered our MIRV programs which were soon followed by Soviet MIRV's which now offer a major threat to our ICBM's.

As far as I know, all of the arms control offers made by both sides have assumed a continuation of the ABM Treaty. Once that is in doubt, it will become much more difficult, if not impossible, to frame logical arm control proposals.

What constitutes an adequate retaliatory force, for example, if both sides are deploying systems to render it impotent?

All the pressures will be to increase rather than decrease offensive forces. There will be a double spiral, offensive and defensive, and that hardly seems to be a good context for arms control to thrive.

I was struck by the general's testimony that an indispensable element of SDI would be an arms control arrangement. As an arms controller, that sounds mighty good to me that we finally recognize that arms control is not something you can take or leave, but it is indispensable.

I would say that our record with the Soviets in working out arms control agreements does not give me much hope that the SDI is going to go anywhere if it depends on arms control agreements.

Arms control already is in bad shape, owing to Soviet negotiating intransigence and alleged compliance deficiencies as well as the American record of apparent disinterest. We have failed to ratify three treaties and abandoned the negotiation of two more. Recently, we have raised the prospect of undercutting SALT II which we had promised to honor even though unratified.

For arms control to work it is important that treaties be stable. There should be a presumption of their continuance, especially when their

terms provide for an indefinite life. The effect of SDI is just the opposite.

It should seem clear by now that the life expectancy of the ABM Treaty is short and both the Soviet and the American strategic programs will be based on that assumption. For strategic stability there should be internal logic and consistency in U.S. policy. The SDI does not fit in this criteria.

For example, the Scowcroft report of 1983 persuaded our leadership that in the long run MIRV'ed systems were not in our interest and that we should move back to a single warhead system like the Midgetman, but the inevitable effect of the SDI will be to put a premium on MIRV's to penetrate the Soviet defensive screens which must now be planned for.

Another example. We recently introduced the concept of build-down into our START proposal. The inevitable effect of a competition for defensive systems will be to raise pressures on both sides to build up rather than decrease the number of strategic offensive warheads.

I wonder, are we not giving the impression that we don't know what we are doing, a state of affairs especially dangerous in a nuclear competition?

SDI does not just present problems for the future. We are already paying a price for reentry into the defensive weaponry sphere. We are not going to try to get ASAT control because of its overlapping technology with defense systems.

We are rattling our allies and destabilizing strategic balance. We are undermining the treaty regime and compounding the difficulties facing our arms control policy.

On the subject of allies, there has been some discussion this morning about that. I was struck in reading the extraordinarily frank and blunt article in "Foreign Affairs," the current issue, by my friend, Colin Gray. He says:

> Ultimately the United States may have to decide whether concessions to the concerns of its allies about strategic defense are worth the price of foregoing the potential for a comprehensive defense and leaving the American homeland vulnerable.

I can't think of a clearer way to split the North Atlantic alliance than to present them with that stark alternative. I think it is a real alternative.

Having talked to people in Germany in the last 2 weeks, I am persuaded this is touching the most senstive nerve that we have touched since the alliance was started.

Administration officials speak of possibly amending the ABM Treaty to accommodate the SDI program. Since the express purpose of the treaty was to ban the very systems that are now contemplated, the amendment route seems wildly impractical as a way to legalize SDI's future.

In fact, whenever I hear the administration say cavalierly we can always amend the ABM Treaty, it sounds to me as if they said one could have amended the Volstead Act to permit the sale of liquor.

The much more likely result of proceeding with SDI is that the treaty will be terminated. When that happens, I suspect the entire existing structure of strategic arms control will be swept away and

any limitations on offensive or defensive systems will be those dictated only by unilateral consideration on both sides.

SDI invites all kinds of concerns abroad, especially in the Federal Republic of Germany, as appeared recently in the statement of Defense Minister Woerner. Images of fortress America and the Maginot Line come quickly to mind.

The French and British must view with anxiety what Soviet offenses to match SDI will mean for their modest strategic forces. The impression in Europe seems to be that the United States is again opting for new weapons at a time when prospects for arms control are especially bleak.

Although our officials console European leaders with the promise that their countries also will come under the defensive umbrellas that we are reaching for, I believe that the common sense of the European population will tell them that inevitably SDI signals a decoupling of their security from ours.

These are costs which are being incurred a decade before the weaponry could possibly be deployed. Anticipations are powerful levers to change public opinion long before the events foreshadowed.

To my mind the most pernicious of the claims for SDI is that it will help with arms control. It is said that once we have demonstrated the resolution and capability to carry out the SDI, the Soviets will take our arms limitation proposals more seriously.

Since any solid progress on SDI will involve termination of the ABM Treaty, it strikes me that the chances for arms control can only be prejudiced by SDI. Ending one set of controls hardly seems a promising way to get on with others.

Incidentally, it seems curious that the proponents of new weaponry generally seem disposed to make this arms control argument. I know few experts in Soviet-American arms control negotiations who have expressed the view that SDI is good for arms control.

The Soviets have already publicly indicated their concern that SDI is an American effort to regain strategic superiority lost in the seventies. It is seen as a system behind which to mount a disarming first strike. It does not seem possible that SDI will increase the Soviet appetite for reaching strategic arms control.

More likely, in my judgment, it has stepped up the Soviet program looking to ballistic missile defense in combination with new efforts to ensure penetrability of their offensive systems in spite of possible new American defensive screens.

I would say if the ABM Treaty is to be terminated, let the Soviets bear the onus. I am well aware of the reports that they are already violating the treaty. The recent report to Congress on noncompliance cited but one case involving the ABM Treaty, that of the Siberian radar. It was qualified as almost certainly a violation.

The administration has not claimed this radar alone has any military significance. It seems to me the United States cannot have it both ways, pursuing a goal that is clearly in conflict with the ABM Treaty while invoking that treaty against Soviet ballistic missile defense activities.

This is not to say that we should not take these charges seriously. I am very much in favor of our pressing hard on each one of these charges that was sent up to the Congress a few months ago.

Both superpowers have long had major ABM programs. Up until now, ours has been a hedge against possible Soviet breakout from the ABM Treaty. That surely is prudent and should be continued, but programs projecting an American breakout are quite another thing.

As the Scowcroft Commission recently concluded, the strategic implications of ballistic missile defense and the criticality of the ABM Treaty to further arms control agreements dictate extreme caution in proceeding to engineering development in this sensitive area.

The consideration, in the legal sense of the word, in the nonproliferation treaty for States not to go for nuclear weapons was a commitment by the superpowers to get on with nuclear arms control.

As we move out into the defensive dimension of weaponry, it seems likely that some countries at least will wonder if the superpowers are keeping their part of the bargain and they may have second thoughts themselves about developing nuclear weapons.

I would stress that we are not talking about another weapon system, but a prospective and radical abandonment of the military strategy of the postwar years and suspension of arms control negotiations during the decade that it will take to prove or disprove the utility of defensive systems.

In conclusion, I would like to cite an excerpt from the recent report on space-based missile defense by the Union of Concerned Scientists. It says:

> The superficial attractions of the strategy of nuclear defense disappear when the overall consequences of BMD deployment are considered. More than any foreseeable offensive arms breakthrough, defenses would radically transform the context of the United States-Soviet nuclear relation, setting in motion a train of events and reactions that would leave both super powers much less secure.
>
> Deterrence would be weakened and crisis instability increased. Damage limitation would be undermined by a greater emphasis on the targeting of cities and increased vulnerability of command and control systems and virtually the entire arms control process would be swept away by the abrogation of the ABM Treaty, the launching of a new offensive round of an arms race and extension of the arms race into space.

Thank you, Mr. Chairman.

Senator WARNER. Thank you, Mr. Smith. Mr. Ambassador, you have objectively referred to the Soviet advancements in their own defense system within the context of the ABM Treaty, presumably confined to Moscow, although there is an open question now whether certain elements have deviated from that treaty.

Were you to advise the President today how to protect this Nation in the event of the rising potential for a Soviet breakout, what magnitude of R&D would you suggest the President take within the confines of the ABM Treaty?

Ambassador SMITH. That is a technical question, but I certainly would be generous in funding legitimate R&D to hedge against the Soviet breakout. No question.

Senator WARNER. I appreciate that because that is the manner in which I have approached this program, that it is basically only the R&D funding of those initiatives which will enable a future President to make the decision with reference to any deployment, in totality or part of it.

So, your reply confirms my approach to this.

Going back to 1972 when you played a very important role in working on SALT I, you inserted the following statement into the ABM Treaty:

> If an agreement providing for more complete strategic defensive arms limitation were not achieved within 5 years, U.S. supreme interest could be jeopardized. Should that occur, it would constitute a basis for withdrawal from the ABM Treaty.

Would you comment today on that?

Ambassador SMITH. That statement was made conditionally. It was not made absolutely. It was related to the life expectancy of the offensive freeze, 5-year life expectancy.

That freeze has been continued by every administration since then and we are living up to it now. So, I don't see that there is any basis for saying that that statement made in 1972 is grounds for our abandoning the ABM Treaty.

Senator WARNER. Senator Exon.

Senator EXON. Thank you, Mr. Chairman.

Thank you, Mr. Smith.

You made a reference early in your remarks that I took to mean that you were quite concerned about the fact that we were placing the MX missile in already vulnerable silos.

Was that what you had reference to?

Ambassador SMITH. Yes. I am concerned about it. I think it is a mistake, sir.

Senator EXON. You did and you do support, I presume, the MX missile in a multiple protective shelter arrangement of some kind?

Ambassador SMITH. I confess I was not intrigued with that basing method either.

Senator EXON. Then do I take it that you are against the development of the MX and its deployment in any kind of mode?

Ambassador SMITH. If we can find an invulnerable basing mode, I would be much more favorable to the MX. I think it wrong to deploy it just because we have had a development program, we have to find some place for it, though.

I can remember General Eisenhower when he was asked what should we do with the IRBM's in 1957, he said, "Throw them in the ocean," and it would have been very good advice to take because it was the existence of those in Turkey, as you recall, that had a very unpleasant effect on the Cuban missile crisis.

Senator EXON. I take it, Mr. Smith, the bottom summation of what you are saying is that you feel that it might be well for us to scrap the MX program and move ahead to a Midgetman or a single warhead arrangement of some type?

Do you think that would be the safest course for the United States and the free world to play at this juncture?

Ambassador SMITH. Yes. I would also go ahead with the bombers and go ahead with the Trident submarines.

Senator EXON. Thank you.

Senator WARNER. Sentor Cohen?

Senator COHEN. One observation. General Abrahamson is still in the audience. I did raise the question about whether or not the combination of offensive capability along with the defensive capability would be more stabilizing or less stabilizing.

The general indicated it would be more stabilizing. I have heard you say that the President recognized it would not be the situation. I have gone back to look at his statement where he indicated that:

> I clearly recognize that defensive systems have limitations and raise certain problems and ambiguities. If paired with offensive systems, they can be viewed as fostering an aggressive policy, and no one wants that.

I think what the President is saying is if you have that combination and they remain in existence, it is not a more stabilizing situation, but a less stabilizing one.

As General Abrahamson suggested, it eliminates the threat posed by strategic nuclear missiles.

At what point in time do we decide that we have a D–5 and MX and the other planned offensive systems plus this proposed defensive capability before we take any action to reduce the offensive systems?

It seems to me we would be at a very critical juncture when we have both in our arsenal and I assume the Soviets would also. I assume the basis of the ABM Treaty was that if one has the capability or the illusion that he can defend against a strike and he also has an offensive capability, in times of crisis the temptation is there to strike.

That is exactly what the ABM Treaty was designed to eliminate.

Ambassador SMITH. That is correct.

Senator COHEN. We talked about modifying the ABM Treaty.

What you are suggesting is if you were to proceed with strategic defense, that would almost per se call for its elimination?

Ambassador SMITH. Yes. I can't conceive of any modification of the ABM Treaty which bans nationwide systems to permit a nationwide, not only that, but a worldwide, system to protect our allies, too. It is nonsense.

Senator COHEN. Thank you.

Senator WARNER. Senator Nunn?

Senator NUNN. Mr. Ambassador, thank you very much for being here this morning and also for the important role you have played for so many years in this whole complicated and informed area.

Looking at Mr. Gray's statement which we will hear in just a minute, but trying to get your reaction to one part of the statement which I think is very interesting and very important, he says:

> Not only is strategic defense not an alternative to disarmament, strategic defense is the only way by which disarmament worthy of the name might be achieved. Absent defense, no one knows how to achieve nuclear disarmament on a scale such that our civilization, and even the ecosphere itself, would not be at prompt or delayed fatal risk in the event of a failure of deterrence.

Mr. Gray makes the case that a strategic defensive system is necessary for long-term arms control in the sense, as I understand it, that we would have confidence to enter into what might now be an agreement on reduction.

How would you respond to that?

Ambassador SMITH. I have not seen Mr. Gray's statement. I have the highest regard for his work in this field.

I have a feeling that in logic it may be correct to say that some day in the wild blue yonder the only way to solve the problem is to have defenses, but I have thought about this for 30 years and I don't know how you get from here to there. The descent is so dangerous.

The questions you asked the general I thought were precisely to the point. At what point does somebody go to the President and tell him the Soviet defenses are so good we have to knock off our offensive programs?

It will work the opposite way. We will work for decoys, penetration aids, and MIRV's on top of which the point about clandestine introduction. The NSC spent hours on that problem.

We used to worry a great deal in the fifties about clandestine introduction, the NSC spent hours on that problem.

Senator NUNN. That is when you would have to bring it in several trunks rather than a suitcase.

Ambassador SMITH. Well, we projected it would be a basketball container by the time we got around to it. I think what happened is that we decided there was no solution, so there was no problem, and we gave up.

But this system is going to, I think, guide the Soviets toward alternative delivery methods.

Senator NUNN. I think that, too. I think unless you are prepared to deal with that in the beginning, you don't have much of a concept for the long term.

What I think is missing now in the administration's presentation is the conceptual framework under which this would be launched.

I say that as one who has supported vigorous R&D efforts in this vein.

I am reading through Mr. Gray's statement. He is on the other side, but I find a more conceptual framework for this SDI effort here than I have in all the statements of all the witnesses for the administration combined. Still I will have some questions for Mr. Gray.

I am saying at least it is being approached from a conceptual point of view and he is trying to deal with it in that way.

I find so far from the administration, piecemeal statements that look at it narrowly and don't pretend to have an answer for the broader view. I hate to say that, but that is what I find.

General Abrahamson is just getting started, so I would specifically not include him in that. But I do think we have a long way to go conceptually.

Let me ask a couple other questions.

The ABM Treaty you feel is very important obviously to arms control efforts and a breakdown of that will lead to a breakdown elsewhere in arms control.

What would you do about what I think is a very real problem in the future, nuclear weapon proliferation around the world?

Suppose we decided we wanted a defense initiative that would give us the authority to shoot down our own missiles if they were launched by mistake?

Say they launched four missiles by mistake. Let us take Third World countries. We are going to have at least 20 countries over the next 20 years that can have nuclear weapons.

Suppose one of them decided to launch an attack against us, would you feel it was worthy of having a limited capability to intercept those kinds of attacks as opposed to what was described here this morning as capability to knock down 30,000, maybe even more reentry vehicles?

If you do believe that is worth the effort, would that not, too, require amendment to the ABM Treaty?

Ambassador SMITH. I think you have put a finger on the great dilemma. If that is what we are concerned about, that the Argentines might lob some nuclear weapons into the United States, to have real protection you would have to have a nationwide system.

You wouldn't know what cities they were going after. So, to be sure, you would have to have a nationwide system. The Soviets couldn't tell if that was just a system addressed to the Argentines; for example, or some other Third World country and not against them.

Senator NUNN. That would not be true if you were able to intercept at the launch phase of a missile, would it?

Ambassador SMITH. Not if you had this permeable umbrella that people talk about. But I think that seems to be receding into the distance each month. We did not hear anything about impermeability this morning.

Senator NUNN. Can you visualize any circumstances in the near term under which you would be willing to significantly alter the ABM Treaty or at least propose it be altered?

Do you feel that treaty is pretty nearly sacrosanct as a foundation?

Ambassador SMITH. I think if we insist on deploying ICBM's in vulnerable silos, someday we might say, "Look, it would be better to have hard point defense against 10 ICBM fields. Let's see if the Soviets would be interested in making a deal."

I think they would ask us to pay a very high price for that. I don't think it is a likely starter. I hope you never ask me to negotiate it. But that is one possibility that I suppose our people should be thinking about.

Senator WARNER. Senator Wilson?

Senator WILSON. Mr. Chairman, in the interest of time, although I do have some questions for Ambassador Smith, I will pass now.

I might inquire of the Chair what time do you estimate we will run to?

Senator WARNER. In view of the interest in this testimony and the importance, the Chair is not able to give you a definite time. I would hope by 12:45 maybe we could suspend.

Senator WILSON. It is not your intention to cut it off?

Senator WARNER. No. I think we are exceedingly fortunate to have this panel. I will give them an opportunity to give a good presentation and be responsive to the members. Then we will have the return of the first panel and schedule an executive session with the first panel.

Senator WILSON. In that case, Mr. Chairman, I will take advantage of just one question of Ambassador Smith.

Would you define for me, Ambassador Smith, precisely the level at which the kind of deterrent development you are talking about would begin?

You are talking about funding generously research and development in responding to the threat of a Soviet breakout?

Ambassador SMITH. I think that some of your sharpshooters will recall the statement that I put in the record in 1972 that in effect says that when it came to the stage of testing a breadboard model, that would violate the treaty.

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I think when you get into testing, except in laboratories, you are violating the treaty.

I would like to submit to you, Senator, a legal analysis that goes into this with much clearer precision than any faulty recollection of 11 or 12 years permits.

Senator WILSON. I would appreciate that.

Why is it, sir, that you reject what seems to me an obvious fact that if hypothetically we were able to achieve a technology that provided us with a real shield, that would not inherently contain a competent arms control regime of its own?

Ambassador SMITH. I suppose even though I have denied technical competence, I have great skepticism about its being possible.

Senator WILSON. Assuming it provides 75 percent of the deterrence?

Ambassador SMITH. If you are talking about population defense, 75 percent capability is just nonsense. The United States would be destroyed if 25 percent of the Soviet warheads got through.

Senator WILSON. Why is it that suddenly the intention of all those directed against SDI is focusing on population centers when they have told us for many years before the Soviets were not interested in the population centers, they were going to destroy our military warfighting capability?

Ambassador SMITH. Because if we go ahead in the first stage and protect our warfighting capability, the Soviet interests will clearly change to hit cities that will be unprotected.

We will not be any more secure than we are now. I think probably less.

Senator WILSON. Your preference is to remain with mutually assured destruction as a deterrent?

Ambassador SMITH. I think we would be years ahead if we could hold onto that and over the years get reductions in offensive systems so that they are less threatening than at the present time instead of launching out into this stream which already is rattling, as I say, the alliance, already promising to divert large sums of money from military programs that I think deserve much more than trying to mount a defense which perhaps will be against the laws of nature.

Senator WILSON. Thank you, Mr. Chairman.

Senator WARNER. Senator Bingaman?

Senator BINGAMAN. Thank you, Mr. Chairman. Ambassador Smith, I think you pointed out that it is a crucial line between research to hedge against the Soviet breakout and research which threatens the Soviets with an antisatellite capability by us.

I understand Dr. Keyworth, the President's science adviser, has been discussing or proposing the deployment of a ground-based eximer laser antisatellite capability by the late 1980's.

On which side of the line would you find that to fall?

Ambassador SMITH. It is my understanding that the treaty says nothing about ASAT systems. I think we could go to a full ASAT deployment and not violate the treaty. I think it is unfortunate. I think is may be considered a loophole.

But we thought we did very well to get the limitations in 1972 that we did and if we then had had an antisatellite killer technology, that might have made the whole thing impossible.

Senator BINGAMAN. I understand the present treaty would not prohibit that. But would you consider the deployment of a ground-based laser with that capability to be a step beyond where our research could prudently take us without creating a Soviet response in their development of a ballistic missile defense?

Ambassador SMITH. I think if we are going to mask a search for ballistic missile defense under cover of an antisatellite program, the Soviets are bound to do the same thing.

If we go ahead with our antisatellite programs full blast, it is perfectly clear to me that the Soviets are going to do the same thing. They have followed suit. We have taken the lead in most weapons development since the war and they have immediately followed suit.

Senator BINGAMAN. As I understand, your view is that going ahead with the antisatellite capability in the various areas that have been proposed might, in fact, really be more of an opening wedge to a Strategic Defense Initiative.

Do you see any tie between those two?

Ambassador SMITH. It certainly would be a parallel development.

Senator BINGAMAN. General Abrahamson said that possibly there was some capability in the Strategic Defense Initiative for defending against cruise missiles, as I understood his testimony. That was new information to me.

I had thought that cruise missiles and bombers were really not to be the objects of any of this strategic defense effort.

I would be interested in your observation as to whether that type of offensive threat would be countered by anything that is planned in the Strategic Defense Initiative.

Ambassador SMITH. Again, because of my lack of technical competence, I can only say in the literature I have read it is stated that the systems that we are looking at now will not have effectiveness against cruise missiles and aircraft.

I think the general said that something may turn up. I suppose that is true of any major research and development program. But I am going on the assumption that if SDI works, then we are going to have to do something about cruise missiles and bombers in addition.

Senator BINGAMAN. That is all I have. Thank you very much, Mr. Ambassador.

Senator WARNER. Thank you very much, Mr. Ambassador. We hope you can stay.

The Chair, after consultation with members of the subcommittee, has made a decision that we will finish today's hearing with this panel.

The subcommittee will have an additional hearing day at which time the first panel will be invited back. We will now continue with this panel with the understanding that upon collection of the testimony of this panel, we will recess for today.

We will next hear from Dr. Kerr.

## STATEMENT OF DR. DONALD KERR, DIRECTOR, LOS ALAMOS LABORATORY

Dr. KERR. Thank you, Mr. Chairman and members of the committee, for the opportunity to speak with you on this important subject.

Clearly there are many different and divergent opinions about the Strategic Defense Initiative which have been expressed by defense analysts, political commentators, and members of the scientific community.

I would like to focus on my thinking about it relative to the technical work we do at Los Alamos National Laboratory and where we begin fundamentally with the question: Where are we in strategic terms and how can new technology including strategic defense technology improve our position?

Deterrent strategic policy is a continuation of the evolutionary process that began in the early 1960's. The United States seeks to deter war by negating the ability of any adversary to achieve his aim by force of arms.

Although strategic policy during these 25 years has relied fundamentally on offensive nuclear forces, the Los Alamos National Laboratory continues to develop and evaluate concepts for ballistic missile defense.

Two years before the advent of the Strategic Defense Initiative we began to expand our approaches to the problems which are now quite varied. We had not yet developed even conceptually a defensive system that we thought could guarantee a highly effective strategic defense, but we were by no means convinced that we could not do so.

In April 1983 we centralized the direction of these efforts and since then we have been giving even more dedicated attention to the technologies that might be developed into effective strategic defense weapons.

Our lab is not alone in pursuing these concepts. Within the Department of Energy laboratory systems our colleagues at Livermore National Lab and Sandia National Lab are also involved. What we are doing is basing our studies on extensive knowledge of the properties of offensive nuclear warheads and their vulnerabilities.

We also at Los Alamos have considerable experience in measuring and modeling the effects of nuclear weapons, particularly the environment that strategic defenses will face.

The particular approaches that we are investigating include, first, those that are based on nuclear systems; that is, evolutionary concepts based on the nuclear devices designed for Spartan and Sprint missiles in the 1960's and more recently revolutionary approaches to harness and direct the enormous energy of nuclear explosions.

Second, in the nonnuclear area we are investigating, in a collaboratory way with the Livermore Lab, electromagnetically accelerated projectiles, the so-called Rail Gun, and by ourselves explosively driven devices to produce lethal projectiles.

For the Department of Defense we have taken the lead in the development of the free electron laser and with laboratory hardware have demonstrated powers of more than a factor of 100 greater than seen elsewhere in the world, still far, at this point in time, from allowing a weapons system to be designed, but still so far also we have not found any way to show that it would be impossible to do that.

We have more modest work in the optical and infrared laser area and we are looking at intense radio frequency sources and, most important, have been looking for more time at the neutral particle beam as a promising approach to a strategic defensive system.

The requisite brightness of an accelerator system was demonstrated in the 1970's. The more recent efforts have been to increase the intensity of the beam to be sure that the divergence is sufficiently small that it would be an effective weapon and that it could be packaged and operated on a space platform.

A concept now exists that would produce such a system for study at least with weights in orbit of some 20 to 70 metric tons, depending on the power required and the range of the weapon system.

A third area that we feel is very important to investigate as part of this research effort is prime power, since any of these systems, whether they are lasers, particle beams, or in some cases kinetic energy weapons, would require power, and hence we have for some time been looking at small nuclear reactors for use in space in cooperation with the Department of Defense and NASA.

Last, and I think directly related to many of your questions, we are conducting substantial investigations of vulnerability, lethality, and countermeasures, since not only do we have to investigate the strategic defense concept, we have to consider what happens to our own weapon systems if confronted in a similar way.

The majority of our support for research and strategic defense is contained within the Department of Energy's budget and relates to those areas specific to nuclear weapon sources and vulnerability analysis. However, we serve as the lead laboratory for Department of Defense efforts in both the neutral particle beam and free electron laser.

Our level of effort within the laboratory DOE program is $43 million in fiscal year 1984 and we have requested $74 million in fiscal 1985.

Our effort in support of the Department of Defense is approximately $17 million this year and we have requested approximately $47 million in 1985.

I do have concerns about the harm that can come from premature criticism in the debate over whether or not the country should put a heavy emphasis on strategic defense.

First, although we have developed many of the important new ideas and concepts through our nuclear weapon technology base efforts, funds for expansion of these efforts in a major way were to be provided by growth in the Department of Energy's nuclear weapons research, development, and testing budget.

I understand there is consideration now within the Congress to decrease that particular category by 5 to 10 percent. Since we have already trimmed our programmatic efforts so far as we believe is prudent and our continuing responsibility of ensuring the most reliable and high performance design for modernizing our offensive nuclear arsenal, the presently contemplated reductions would seriously affect the contribution I believe we could make in the strategic defense area.

Similarly, I am told by the Department of Defense that the House Armed Services Committee is contemplating not only a substantial reduction in the budget request for neutral particle beams, but is considering a budget that would actually cause a reduction in fiscal 1985 below the current effort.

Again, I would caution against this reduction.

In our research to date the neutral particle beam would appear to be the most advanced of the direct energy technologies in terms of its performance relative to the proposed requirement.

Our work in analyzing how best to harden reentry vehicles against direct energy attack leads us to believe particle beams are the more resistant to countermeasure than any of the technologies.

As a first step, research and development may make available a strategic defense system that we could add incrementally to our offensive forces maintaining the viability of our current policy. Limited defenses might improve our ability to manage crises successfully. They could defeat small or accidental attacks.

By protecting command and control and national leadership and by reducing the effectiveness of the attacks, they could allow us to respond with deliberation.

These defenses could also help us to protect a portion of our land-based retaliatory forces, the very forces on which we chiefly rely for controlled limited responses.

Admittedly such limited defenses would by themselves do little to protect people from anything but small nuclear attack. By allowing us to continue to effectively deter limited attack on us and our allies and to continue to avoid moving toward the threat of massive retaliation, our limited response defenses may make war less likely and offer what ever hope there might be of halting a nuclear war if it ever began.

I should note that the addition of limited defenses would not allow us to give up our offensive nuclear forces. However, reductions of these forces through a negotiated arms control agreement would continue to be desirable since the job of the defenses would be easier against the smaller threat.

It is often argued that adding defenses would lead to an increase in offensive arms and make arms control more difficult. Obviously, this is something we must carefully avoid.

If we do decide to begin incrementally additions of defenses to our present forces to fortify our deterrent policy, that need not be in opposition to the longer term goal of moving toward a more defensive posture which would rely less on offensive threats and more on protecting our people.

For many years we will not have any possibility of higher effective population defenses. When and if more progress is made in the development of strategic defense technology, we may be in a position to move toward a new, more defensive strategic policy.

But we probably do not need to aim only at so-called total defense, perfect leak-proof defense, in order to improve our policy and security. Defenses far less than perfect might practically foreclose the use of certain offensive nuclear forces to accomplish any realistic and useful national objective.

What I have tried to indicate is that strategic defenses could prove to be very valuable to strategic policy as currently formulated and may, if their promise is fulfilled, go on to contribute to new, safer policy in the future.

For a number of reasons we may ultimately decide not to go ahead and deploy defense systems. I think our approach to research and development on strategic defenses should be vigorously positive on the technical side, but cautious with respect to future deployment.

The present program, from my point of view, is just that. The Government is currently committed to an R&D program, not to deployment, of defense. A number of defensive weapon systems and concepts are in development which have very different technical characteristics, very different potential capabilities against present and future offensive forces and certainly very different implications for strategic policy.

We do not yet know which concept will lead to practical weapons, that is, weapons effective in their proposed military role, technically feasible and economically sensible. Nor do we know the strategic situation that might prevail when we are in a position to decide whether to build and deploy these weapons.

We are not yet in a position to decide to deploy defenses, but we would be improvident to deny ourselves the choices these programs may open to us.

Thank you, Mr. Chairman. In the interest of time, I think I will stop there.

Senator WARNER. Thank you very much, Dr. Kerr.

The Chair will limit himself to one question and hope we can proceed.

I read with interest the analysis of the Union of Concerned Scientists' report and would like to have your view on that.

Mr. KERR. I think the Union of Concerned Scientists' report in many ways helps illustrate the great difficulties involved in first devising and then developing the technologies that might be used for strategic defense.

They have properly focused on the concerns with command, control, countermeasures, and vulnerability. In some cases I think their analysis has either been overly simplified for the purpose of the public document that it is, or at least in one case totally in error.

For example, their estimate of the weight of a neutral particle beam weapon system is off by a factor of something like 1,600. I think Dr. Garwin to my left now understands there seems to have been an error by some of the physicists who made that analysis.

They also, in my view, overestimated by a substantial factor the number of satellite systems one would need to provide continuous coverage, for example, of the Soviet ICBM field. How one does that analysis clearly depends upon how much one wants to invest in it, but I have seen now three different analyses that lead to numbers on the order of 400 satellite weapons for continuous coverage of all of the existing silos.

Clearly, if one as a policy matter wanted to have less capability than 100 percent coverage, that is, a crisis management capability, the number could be far smaller than that 400.

So, I think on the one hand the Union of Concerned Scientists has done a service to the country in raising these issues. I would hope that a longer term, more sophisticated analysis, albeit one still in the open, unclassified literature, might dispel some of the inaccuracies that are also in it.

Senator WARNER. Thank you.

Senator Exon?

Senator EXON. I thank the chairman.

I have just one question, Dr. Kerr.

You made the statement in your testimony that our basic assumption has been to negate the enemies' options. You at Los Alamos have been before us in closed testimony and I congratulate you for the excellent strides you are making.

As far as the present systems are concerned, I believe that you have done some research at Los Alamos on hardening of silos basically for the MX; is that correct?

Mr. KERR. We have done some work in that area, Senator Exon, but the major program investigating silo hardness has been conducted by the Defense Nuclear Agency. They have in their studies and analysis found that there are construction techniques that can be used to substantially increase the hardness of silos.

Our contribution has been mainly in looking at the so-called deep basing concepts. All of these, of course, address that very fundamental question, ensuring the survivability of our strategic forces.

Senator EXON. In that regard, as a final question, do you have an opinion as to whether or not you think it is wise, in the context of negating the options that the potential enemy might have, to place the MX in admittedly vulnerable silos?

Mr. KERR. I think that choice, Senator Exon, is in part a political choice, one that was put together as part of the work of the President's Commission on Strategic Forces. There are really two points to have in mind.

One, of course, is that our entire ICBM force is held at risk at the present time, not just the MX. The need to in fact have a modern ICBM I think is as important as the question of the survivability.

The combination of the MX, which is a modern capable weapon, and possible measures to make it harder in whatever deployment mode is ultimately chosen, the silos at the present, is to me a sensible compromise, particularly when I look at the limitation of numbers that are being both imposed by the administration in its request and by the Congress is its disposition of those requests.

Senator EXON. Do you feel from a strategic standpoint, from a deterrence standpoint in negating the enemies' options, that it would make more sense to have some other type of deployment than putting MX in admittedly vulnerable silos, even given the situation that it might have been a political decision rather than a military one?

Mr. KERR. I guess from a pragmatic point of view, I would have argued that theoretically one would wish to have a survivable system against any threat you could perceive, that is, any well assessed threat you could perceive.

Finding that it was politically impossible to reach an agreement on a basing mode that would have survivable characteristics, I think the recent compromise is as good as we can have at the present time.

Senator EXON. Just a comment. I would simply say that the political compromise that was made in this particular area was a terribly bad strategic move. I think that that is recognized in the community in which you serve. I think that is recognized by most of the military experts that served under previous Presidents and it is well recognized by those who serve under this President.

But it has been muted because it can't be challenged. It was a political decision that was made and I think eventually history will show that that decision which was made and announced I believe on October 2, 1981, literally turned upside down the planning of previous military commanders and Presidents. It was a wrong one, it was a caving in to the political judgment.

I recognize there had to be an understanding and a consideration of the two, but I think military judgment should come first.

I won't ask you to comment on it because I don't suppose you want to.

Senator WARNER. Senator Wilson?

Senator WILSON. I will pass, Mr. Chairman.

Senator WARNER. Senator Nunn?

Senator NUNN. I have just a couple of questions, Mr. Chairman.

Dr. Kerr, if I heard you correctly, you were making it clear, as I understood it, that you think the protection of population is a long-term and rather improbable goal.

Is that too strong a reading of your words?

Mr. KERR. I think I used somewhat different words, but I wouldn't quibble. I think the protection of population with any certainty is in fact a very long-term goal.

In fact, I think one might better think of this problem of strategic defense as one of balancing your investments very similar to the thinking you do when you balance the air-breathing leg, the submarine leg, and the ICBM leg of our offensive forces.

Senator NUNN. You are saying SDI would be more in the nature of protecting retaliatory forces and limitied protection against limited attacks?

Mr. KERR. I was heading in a somewhat different direction in thinking that as one developed the capability to defend against ballistic missiles, one would have of necessity to force the adversary to look at other delivery techniques, as you pointed out. That would force you to develop improved air defenses and perhaps even civil defenses in order to have a balanced defense capability against an evolving offensive threat.

Senator NUNN. How then would you describe what you envision the long-term goal should be in terms of population protection, how would you describe the goal of SDI in terms of protecting population?

Mr. KERR. I think the words "long term" are the operative ones here. There are two points to make in specifically answering your question.

First of all, I think it will be a fairly long period of time before we know enough about these technologies to decide whether they are effective broadly or specifically. That is, whether they would have the elements of protecting areas of the country versus simply protecting military forces.

Senator NUNN. How far down the road do you envision that?

Mr. KERR. My own judgment is that we are on an order of a decade from the point where you would go into a full-scale engineering demonstration of some of these technologies because of the need to integrate the work in pointing and tracking, the work in acquisition, fire control along with the weapon systems themselves.

Senator NUNN. How far down the road would you be beyond the engineering and development stage before you could actually, if things

worked out, visualize the population in this country would be protected?

Mr. KERR. Honestly I don't know because in fact it would depend rather specifically on which path or paths would be followed.

First of all, we are not talking about a system, in my judgment. We are talking about several layers of defense, probably starting with boost phase, continuing into midcourse and ultimately into the terminal phase.

How that would be deployed and how it would particularly be deployed incrementally, as it would of necessity have to be, I can't judge at this point in time from my perspective which is dealing with the technical feasibility of some of the weapons concepts that we are presently studying.

Senator NUNN. In terms of breaking it out, and let us say the near term, the decision we have to make is concerning the $26 billion program. What is an appropriate balance in directing the program toward that very long term and, to use my words that you didn't quibble with, improbable goal of protecting population?

In other words, where does that rank on the scale of what we ought to be doing?

Mr. KERR. In my view, given the present state of maturity of various technical approaches that are being worked on, you can't tell at this point in time which goal you are working on.

That is, the goal to be effective against ICBM's, whether it is to protect our land-based strategic forces or whether it is to protect certain areas or the entire country, can't be discerned.

The reason is that there is not sufficient maturity in what is known in a technical and engineering sense to see any difference.

Senator NUNN. You are saying the beginning phases of this program will be the same independent of whether your goal is to protect population or to protect retaliatory forces?

Mr. KERR. I think in general terms that is true. There may be some specifics within the program where that would not be, but I don't know what they are.

Senator NUNN. You mentioned you envision an effort much broader than protection of individuals. You visualize protection against air breathing, and so forth.

Is there a corresponding effort in this area? Are you satisfied that this whole thing has been thought through in a comprehensive fashion and we indeed have a long-term parallel type effort going on to protect populations from nonmissiles?

Mr. KERR. I am really not prepared to answer that, Senator Nunn, in that I can speak with some basis only in the areas where our laboratory works.

Senator NUNN. Do you think we should have that——

Mr. KERR. With respect to defense against cruise missiles, there are programs in existence now. Whether they are sufficient, I am not in a position to judge.

We also, of course, in this country have the programs of FEMA, the inheritor of the old civil defense program. Again whether they are sufficient, whether they are balanced properly, I can't answer.

Senator NUNN. Thank you very much, Mr. Chairman.

Senator WARNER. Senator Bingaman?

Senator BINGAMAN. Thank you, Mr. Chairman.

Dr. Kerr, would you just comment briefly on the interplay between the Strategic Defense Initiative and our efforts in antisatellite weapons?

What I am getting at is that it strikes me that many of the technologies that people are discussing for possible use in antisatellite weaponry are really the same as those that are involved in the strategic defense effort and that going forward in the antisatellite weaponry area, as we appear to be, is going to have a significant undermining effect on our ABM Treaty.

Could you just comment on whether or not there is a tie there that this committee and this Congress needs to be aware of before it acts on either SDI or ASAT?

Mr. KERR. Yes, Senator Bingaman. I think Ambassador Smith answered the question quite forthrightly in terms of the treaty.

With respect to the technical side of it, it is very clear that, for example, a space-based weapon system capable of engaging a reentry body would also be capable of engaging a satellite since satellites are not, for example, normally protected to the levels that a reentry body is to survive its entry into the Earth's atmosphere.

As Ambassador Smith pointed out, there is this emerging loophole in the treaty. These capabilities were not envisioned when the ABM Treaty was negotiated in 1972 and consequently it focused on limiting the sorts of ABM technologies that were thought of in the late 1960's, that is typically nuclear weapons on interceptor missiles.

Those weapons also, the high altitude ones at least, had the capability of destroying satellites, as we found to our embarrassment in 1962 on some of the high altitude tests.

The loophole exists, as a matter of fact the technical connections are clear that you can project something, kinetic energy or a beam or a laser beam, that it would have capability against satellites.

The decision to do that and what policies are implied would just have to be made in full knowledge of that fact.

Senator BINGAMAN. Thank you.

That is all I have, Mr. Chairman.

Senator WARNER. Dr. Gray.

## STATEMENT OF COLIN S. GRAY, PRESIDENT, NATIONAL INSTITUTE FOR PUBLIC POLICY

Mr. GRAY. Thank you, Mr. Chairman.

I don't think there will be too many subjects left unaddressed, but I will see if I can cast a little light. You will notice there will be a fair amount of contrasting testimony with some of the previous statements.

I would like to begin by saying something about how I conceive the SDI, what it is and what I believe it is not. I should emphasize, to begin with, that I am not here today to defend or to explain Government policy. I am speaking solely as a private citizen.

The country deserves a forward-looking debate on strategic defense, but I am afraid that the attitude of many people toward this subject was forged 15 or more years ago, and that their minds are not open, as I think they should be, to new possibilities.

For example, I believe that there is a widespread tendency to consider the ABM Treaty sacrosanct, forgetting what arms control is all about.

Arms control, first and above all else, is about reducing the risks of war—that overriding goal may or may not be served by a particular, formal treaty regime. If an arms control treaty precludes weapons development and deployment that should reduce first-strike incentives, then that treaty does not function as an arms control measure.

The ABM Treaty of 1972, as amended in 1974, reflected contemporary predictions concerning probable trends in strategic offensive forces that have not been borne out by events.

The treaty is a hindrance to sound defense planning and is an obstacle to achievement of the goals of arms control, properly understood, if it is invested with great inherent symbolic value.

I am not suggesting that the United States provide notice of withdrawal from the treaty, or even that a determined bid for amendment be made now. But we need to remind ourselves that that treaty is a means and not an end.

The SDI is a range of possibilities, near and far term. Public explanations of the policy story behind the SDI have varied in the aspects that they have emphasized. I believe that there is a coherent policy rationale for the SDI that can and should be advanced; one that relates the near term to the far term, that accommodates possible and probable Soviet reactions or initiatives, that explains the near- and far-term roles of strategic offensive forces, and that embraces a realistic understanding of the value of arms control negotiations.

I am supportive of what I understand the SDI to be about. However, there are many legitimate and very important questions to pose and answer concerning the risks and benefits of the United States seeking to effect an orderly transition to a strategic posture that rests increasingly upon defensive capability. I should stress here:

I am no less critical of unrealistic visions of a near-term astrodome defense, than I am of those people whose opinions appear to have been fixed for all time by the positions they adopted during the great ABM debate of 1969–70.

Senator NUNN. What do you mean by astrodome defense?

Mr. GRAY. By that I mean a roof over the country that would preclude offensive action. That would be a leakproof defense.

Senator NUNN. Would you include in that the implication we would be able at some point to abolish all offensive weapons?

Mr. GRAY. That I will come to. Not necessarily. We could have an astrodome defense of the United States, but we may retain offensive forces that maintain the ability to get into Soviet territory.

Senator NUNN. I am trying to understand what your statement has described as astrodome defenses.

Mr. GRAY. I have noticed statements by public officials from the highest level that appear to imply that leakproof defenses really were our objective.

There are other people who have argued that something close to the leakproof defenses may be attainable in the relatively near term. I am just saying, as my personal position, that I am critical of those who argue this to be feasible in the near term.

I remain agnostic about the distant future. Let me say what I think the SDI should be. I believe it should be:

An exploration of ways in which the stability of the existing system of offensive, retaliatory deterrence might be enhanced.

An exploration of ways in which the terms of deterrence might be transformed in favor of much greater safety for civilians everywhere.

And the only remotely feasible path by which nuclear disarmament on a truly massive scale might be secured.

The SDI should not be:

A weapons program at this point in time.

A promise that society as a whole for certain can be defended directly—we don't know that.

A quest after some ever-elusive, illusory ultimate weapon—such cannot exist.

And a promise of political peace.

Lest the point be lost in subsequent discussion, I wish to emphasize that Soviet-American rivalry is political in its origins, is fueled overwhelmingly by political anxieties and ambitions, and can be alleviated or resolved only by political action.

Those of us who strongly favor the possibilities inherent in the SDI are under no illusions about the limitations of a technological peace. Should the SDI prove to be a magnificent technological success story, which—looking out 20 or 30 years from now—is certainly possible, strategic defense will not be a panacea for deeply political security problems.

The SDI and a defensive transition I believe can change the terms of deterrence, away from retaliatory nuclear threat—which would be no small accomplishment—but, in and of itself, it cannot arrest the arms competition. The last move in that competition must be political, not military technological.

### THE PROBLEMS WITH RETALIATORY NUCLEAR DETERRENCE

In thinking about the dangers of a defensive transition, plausible and otherwise, there is to date a tendency for people to consider strategic defense out of its proper context of real policy alternatives.

A very major portion of the case for proceeding with the SDI, in my mind at least, is the virtually self-evident fact that there are no attractive alternative paths to greater security.

Eventually, the Soviet-American rivalry will be resolved, hopefully by formal or tacit political agreement rather than by military decision. However, historically speaking, all security systems break down or are transformed as conditions change.

The nuclear deterrence system familiar to us today, with very dominant offensive capabilities, is just fine all the time that it either functions as we intend or, as generally is the case, all the time that it is not severely tested.

The problem, indeed the enduring problem, is that we are resting our future upon a nuclear deterrence system concerning which we cannot tolerate even a single serious malfunction.

Thirty-nine years into the nuclear age it is uncertain whether the absence of bilateral nuclear war should be attributed more to luck than

to sound policy. The question is: For how long should we expect this system of reciprocated nuclear retaliatory threats to work satisfactorily?

You may be confident that stability reigns today, but how confident can you be for the next 50 or 100 years?

The SDI and a defensive transition cannot effect a benign transformation in the policies of East-West competition, but it may—and only may—serve to buy us time for the alleviation and resolution of political differences.

At the very least, I believe it would be grossly irresponsible and imprudent for us to refuse the challenge to try to live in greater safety with nuclear weapons that cannot be disinvented.

### THE SDI AND THE QUEST FOR A SAFER FUTURE

It is always possible that as a consequence of focusing upon the shape of distant woods one may walk into a tree or two in the foreground.

I agree wholeheartedly with James Woolsey and others who have stressed the importance of approaching and managing a process of defensive transition with extreme care. While I believe it to be essential that we understand whether we intend to proceed, in the far term, with strategic defense, there is everything to be said in favor of being cautious lest the price of the journey to a defended America be an increased risk of war along the way.

Before discussing transition issues in some detail, it is important that we appreciate the range of choice available to us as a Nation. If you reject the very idea of strategic defense, you are, ipso facto, endorsing the seemingly endless competition in offensive nuclear arms.

The alternative to the SDI is not a happy world of superstable, jointly well managed offensive arsenals, instead it is a world of acute competition and anxiety over net warfighting prowess that cannot withstand a single breakdown in the extant deterrence system.

Not only is strategic defense not an alternative to disarmament, strategic defense is the only way by which nuclear disarmament worthy of the name might be achieved. Absent defense, no one knows how to achieve nuclear disarmament on a scale such that our civilization, and even the ecosphere itself, would not be at prompt or delayed fatal risk in the event of a failure of deterrence.

Even the offensive forces builddown proposal, which the Soviet Union has rejected in very unflattering terms—describing it in "Pravda" as being "designed for fools"—would leave the superpowers with truly massive nuclear arsenals.

If we are serious about nuclear disarmament, which we should be, and given that we do not know how to achieve a general political settlement with the Soviet Union that would render issues of competitive nuclear armament politically irrelevant, we have no prudent choice other than to press on carefully—I emphasize carefully—to explore the possibilities of strategic defense.

Only in the presence of multilayered strategic defenses would the superpowers be able to endorse a very radical scale of nuclear disarmament. With such defense, we—and they—could live with a disarmament treaty that would not be verifiable with absolute confidence.

There is no way that a nuclear disarmament treaty would be verifiable with absolute confidence.

In the absence of homeland defenses, the incentive to cheat on a disarmament regime would be matched only by the ease with which the Soviet Union could cheat.

Far distant though the prospects of nuclear disarmament may be, it is essential, morally and politically, that the U.S. Government should be able to articulate a not-implausible theory of how such disarmament might be affected in ways compatible with U.S. and U.S.-allied security.

This theory should be an integral part of the policy story for the SDI, notwithstanding the proximate necessity for having a very prudent and robust appreciation of the difficulties attendant upon proceeding from here to there.

### MANAGING A DEFENSIVE TRANSITION

I would like to turn now to the SDI and the management of a defensive transition. Whatever may or may not be possible eventually by way of the active defense of American cities, the first necessary steps must be the intermediate capabilities emphasized in the Hoffman report for the protection of U.S. retaliatory forces and $C^3I$ assets.

These capabilities would comprise necessary underlayers for what might one day become a comprehensive architecture of nationwide defense. I say "might," not "will."

But, whether or not boost phase and postboost phase defense proves feasible, terminal nonnuclear defenses could provide a very attractive way of strengthening strategic stability. Such defenses would have to promote massive new uncertainties in Soviet attack calculations—calculations that already are beset with major technical, tactical, strategic, and political uncertainties.

American policymakers in the 1990's should be provided with active defense alternatives, or partial alternatives, to the proliferation of offensive weapons, the proliferation of aim points through mobility of offensive weapons, and the adoption of dangerous launch tactics.

We need not decide today whether the country will exercise such intermediate defensive options, but the case for purchasing the ability to choose in a timely fashion would seem to me to be overwhelming.

Probably the single most frequent objection that is raised to the nearer term aspects of the SDI and a defensive transition is that it will stimulate the arms race. This objection is really no more than a truism, albeit an important truism.

Any U.S. strategic force development which threatens to thwart some aspects of Soviet strategy, to deny some measure of military advantage, may serve as fuel for Soviet competitive behavior. There are some interesting cooperative possibilities for a defensive transition, but those possibilities can rest only upon effective U.S. competitive performance.

There are no free lunches in this business, in other words.

The Soviet Union certainly will be motivated to seek to dissuade us from pursuing the SDI and an effective defensive transition. Dissuasion will take the forms of weapon development optimized for pene-

tration of defenses and, very likely, of arms control blandishments. Something specific about arms control and opportunities in that realm may help.

### THE SDI AND ARMS CONTROL

Should the United States decide to move with the SDI from technology exploration into weapon development, formal arms control negotiations could assume great importance.

First, late in the 1980's the United States may wish to renegotiate the terms of the ABM Treaty of 1972 so as to permit development and limited deployment of strategic forces and strategic C³I facilities. American policymakers would confront a choice that relates to the heart of deterrence reasoning.

Should they seek an arms control regime that would assist the prelaunch survivability of nuclear forces, though at the price of impeded access, courtesy of Soviet BMD deployment, to Soviet territory? Or, should the ABM Treaty be retained in its pristine form, at the price of denying U.S. forces and C³I a potentially valuable measure of prelaunch survivability?

I believe it would be wise to choose prelaunch survivability rather than unimpeded access to Soviet territory, but that may be a matter of legitimate debate.

Second, later in the 1990's, or perhaps early in the next century, the opportunity could arise for a truly radical, benign restructuring of strategic forces through the arms control process.

While the effectiveness of a U.S. defensive transition can never be permitted to hinge upon cooperation with the Soviet Union—for the obvious reason that they seek military advantage over us, and certainly they seek to deny us military advantage—I do not believe we should ever permit the SDI, in the transition, to rest on the requirement that the Soviets and ourselves negotiate an agreement. Nonetheless, there is no doubt that a large-scale reduction in the quantity of Soviet offensive forces, not to mention some qualitative restraints upon the forces that remained, would enhance greatly the prospective performance of our defenses.

So, the problem then, as today, is one of negotiating leverage. How do we persuade them to agree?

The President's vision of a much reduced scale of nuclear threat is more likely to be achievable if the Soviet Union can be brought to believe that nuclear disarmament on a massive scale is in its net security interest.

This will not be a matter of strategic theoretical persuasion, of lectures on the new U.S. theory of stability through dominant defenses, nor will it be a matter of devising ingenious formulae for reciprocal reductions.

Stated directly, Soviet leaders and strategic planners will need to look at the actual and the potential of U.S. competitive performance in defensive and offensive weaponry, and hopefully decide that they face an important military disadvantage if they choose to let the competition run its course in a legally unregulated fashion. They must prefer a regulated strategic future.

By way of a contingent prediction, if Soviet leaders believe that U.S. offensive forces will fare considerably better against Soviet defenses

than will Soviet offensive forces against U.S. defenses, then they should be motivated to agree to a negotiated drawdown in offensive forces.

In American perspective, given that we are far more interested in protecting Americans than we are in threatening Soviet citizens, we should be prepared to forgo some measure of military advantage with the superior penetrative prowess of our offensive forces, as a price well worth paying for the reduction in the scale and quality of the Soviet offensive threat.

### NUCLEAR AMBUSH OF A DEFENSIVE TRANSITION

Some critics of the SDI have expressed concern that should the Soviet Union anticipate the United States achieving a significant military advantage through defensive deployments, it may elect to take very forceful measures to prevent our defensive transition, or addition, from maturing.

Several responses to this valid concern are appropriate, but the leading one is to the effect that it must be a mission of the strategic offensive forces to guard the defensive transition.

It so happens, as noted already, that very potent offensive forces should serve both to discourage Soviet adventurism in the near term, and—in the longer term—could serve to provide the Soviet Union with the incentive necessary to negotiate the major drawdown in offensive forces that must enhance the effectiveness of U.S. defenses.

The nightmare scenario of a desperate Soviet Union choosing to fight today rather than live with the consequences of a measure of military inferiority tomorrow, is thoroughly implausible, if not totally ridiculous.

Should Soviet leaders anticipate military disadvantage as the defensive transitions—theirs and ours—mature, the extant U.S. offensive force posture, if properly modernized through this decade, would provide them with the most persuasive of reasons for eschewing prompt military adventure.

Even if the military balance tomorrow looks to be worse to them than that today, the balance today is most unlikely to offer a good prospect of success.

Furthermore, Soviet leaders will have an attractive alternative both to suicide today and to inferiority tomorrow—and that is a defensive competition managed by arms control.

The point should not be missed that the earliest U.S. deployment action in a defensive transition will be for the defense of strategic retaliatory forces and $C^3I$. That deployment must function so as to discourage any Soviet theorists of nuclear ambush for our defensive transition.

The SDI and a defensive transition will not be among those phenomena where we must purchase the entire edifice before we have any useful capability. Near-term active defenses will be of immediate value, they could transform the terms of debate over land-based missile deployment, for an obvious example, and they will provide useful deterrence cover for whatever the defensive transition may become.

Senator NUNN. May I interrupt at this point because I think he is making a very key point and a very persuasive argument.

You talk about getting to the point where the Soviets look at the overall offensive and defensive combination and they see ours will be stronger than theirs. All our testimony, particularly in closed session, indicate we are not going to get to that point at any foreseeable time and certainly not within the next decade.

So, while that is a logical argument, a very persuasive argument and attractive argument you make on page 10, that doesn't fit with any of the facts that we have in terms of our testimony.

The second point is another very logical cogent argument, "The point should not be missed that the earliest U.S. deployment action in a defensive transition will be for the defense of strategic retaliatory forces and C³I."

That is precisely what we are deemphasizing in the administration's program. The administration's program is deemphasizing the short term and emphasizing the long term.

I am not saying that, either/or, one should be cut off completely, but that is the whole thrust of the budget revisions and the things that have happened since the President's so-called Star Wars statement.

You are making a logical and persuasive case for a program that is not before us, as I see it.

Mr. GRAY. Senator, the administration must speak for itself.

Senator NUNN. I realize you are not speaking for them.

Mr. GRAY. I am probably about as aware as you on the intelligence side in regard to where our defensive programs are and where their defensive programs are.

I share your concern that the Soviets do indeed appear to have a nearer term breakout, persuasive breakout capability for near-term deployment of strategic defenses than we have, which is an unfortunate fact. That does appear to be the case today.

The point I was talking about theoretically here is in the early to mid-1990's, the Soviets, I am emphasizing, should see a worse future for themselves.

Senator NUNN. Indeed if they do have a near-term breakout, and if the testimony is correct that we have had so far, a lot of it classified, then the very incentives you lay down as being attractive to them should at this point be attractive to us.

I wish it weren't so. I am not sure that it is so.

Mr. GRAY. I am not as pessimistic as your tone would imply.

Senator NUNN. I am not as pessimistic as the testimony we have received. I am saying that the record shows.

Mr. GRAY. We are dealing here with a legacy of more than 10 years of funding of our defensive programs under the ABM Treaty. There was never a good year to amend the ABM Treaty.

At some point I believe you have to bite the bullet. I think you will find many of our officials look at the balance and relative breakout capability and say, "Boy, this is not the year to do it. Look at the lead they would have over us in terms of deployed hardware for 4, 5, or 7 years from now."

The next time review comes around you will say things have not gotten better. I believe the politics of the situation have been changed by the President's SDI. The fact of our drifting in the same situation, review after review, but never finding the right year, may be changing.

I believe the factual basis for the theory in my prepared statement should be more with us in the years ahead than certainly is the case today.

With regard to the balance in the official program, it is not my understanding that many of the folks in the administration who are arguing both near and far term are in a very substantial way trying to deemphasize the nearer term technology.

Senator NUNN. That is what the funding is.

Mr. GRAY. I can see the funding may imply that.

Senator NUNN. That is the case. That is the testimony we have had.

Mr. GRAY. If that indeed is the case, then I would share your concern.

Mr. Chairman, much was made, and I think appropriately so, in questioning earlier witnesses in regard to the impact, real and possible, of the Strategic Defense Initiative on the western alliance in NATO-Europe. My article in "Foreign Affairs" was quoted and criticized.

I will say a few words directly about the impact of strategic defenses in the American defense program and their impact politically on the whole western alliance, to answer the critics.

Critics of the SDI are able to point, accurately enough, to some disquiet in NATO-Europe over what U.S. strategic defense developments may imply for East-West relations and for U.S. motives and prospective performance as a security guarantor to our allies in Western Europe.

Space precludes detailed treatment of this issue here, but the following points are relevant:

Near-term strategic defense developments, for the enhancement of the prelaunch survivability of U.S. strategic forces, systems I believe could be deployed in the 1990's, would simply strengthen the familiar terms of nuclear deterrence.

I am talking about enhancing the survivability of our offensive forces. That is the near-term story, I believe.

Second, near-term, point-defense technology, if deployed in Europe, would greatly strengthen the stability of deterrence.

ATBM defense against shorter range Soviet missiles would deny the Soviet Union an important measure of confidence concerning the prospects for conventional success.

ATBM defense of NATO airfields, supply dumps, $C^3$ facilities, transportation nodes, and the like, would play a literally vital role in facilitating the defense of NATO-Europe, and—ergo—in discouraging aggression.

Far-term defensive technology—probably space-based, or space-deployable—could protect U.S. allies as well as the United States itself.

Moreover, if we can move into an era wherein the American homeland enjoys a growing measure of direct, physical protection, the willingness of U.S. Presidents to run risks on behalf of distant allies logically should be strengthened.

Far from being an instrument with decoupling implications, strategic defense would work to enhance solidarity of behavior in crisis and war.

Soviet strategic missile defenses must work to challenge the credibility of the small national deterrents of France and Britain. However,

those deterrents do not work politically by reason of their certainty of penetration of Soviet space, but rather by reason of Soviet uncertainty concerning their employment.

To the end of the century, and probably beyond, the French and British national deterrents would retain sufficient potential to leak through Soviet defenses that they would not face an immediate crisis of technical relevance.

For the longer term, should the superpowers both proceed to deploy heavy, multitiered nationwide defenses, then small nuclear forces, no matter how sophisticated their penetration aids, should indeed lack credibility.

Given the benefits of a defensive transition in strategic forces, and the likely very high scale of effectiveness of theater and tactical missile defenses in Europe, NATO-European countries should welcome the opportunity to be able to devote their attention wholeheartedly to the problems of local conventional deterrence.

Senator WARNER. You are about to read your conclusions. Since we have followed your text as a means of presenting your direct testimony, may I ask in deference to members of the committee and remaining witnesses that you summarize that portion.

The caucuses of both the Republicans and Democrats are about to convene in the next 20 to 30 minutes. It is important that we all attend our caucuses.

I want to provide our next witnesses an opportunity to present their views, if you will be kind enough. I would also ask that you provide us with a copy of your recent article in Foreign Affairs for the record.

Mr. GRAY. I will.

I will conclude by saying I wish to submit to the committee that the Strategic Defense Initiative and the defensive transition can even in the near term assist critically in enhancing attack-planner uncertainties and help stabilize deterrence and thereby reduce the risk of war occurring.

Next, SDI in the defense transition may in the far term be the only way in which damage limitation can be enforced in the event of deterrence breakdown.

Finally, given the sharp downward trend in offensive nuclear capabilities that a defensive transition eventually should encourage, it is at least possible the economic burden of peacetime preparation will be no greater than would be the case were the United States to continue to rely solely on an offensive nuclear deterrent.

On balance, I believe the case for proceeding with the SDI and the defensive transition in terms that the administration outlined is overwhelming. We know what we can do to complicate the attacker's planning in the 1990's and we should remain agnostic as to what is possible for city defense at that time.

If we are to escape from the dilemma of nuclear deterrence, reliance on offensive nuclear defense, there is no alternative but to see where SDI will take us.

[The information follows:]

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FOREIGN AFFAIRS

# NUCLEAR POLICY AND THE DEFENSIVE TRANSITION

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# NUCLEAR POLICY AND THE DEFENSIVE TRANSITION

On March 23, 1983, President Reagan delivered a televised speech to the nation in which he initiated a potentially radical departure in U.S. strategic policy. The President suggested that the policy of nuclear deterrence through the threat of strategic nuclear retaliation is inadequate, and called upon the vast American technological community to examine the potential for effective defense against ballistic missiles:

> Would it not be better to save lives than to avenge them? Are we not capable of demonstrating our peaceful intentions by applying all our abilities and our ingenuity to achieving a truly lasting stability? I think we are—indeed we must.
>
> After careful consultation with my advisers, including the Joint Chiefs of Staff, I believe there is a way. . . . It is that we embark on a program to counter the awesome Soviet missile threat with measures that are defensive. Let us turn to the very strengths in technology that spawned our great industrial base. . . . I know this is a formidable technical task, one that may not be accomplished before the end of the century. Yet, current technology has attained a level of sophistication where it is reasonable for us to begin this effort.[1]

The central problem of nuclear deterrence is that no offensive deterrent, no matter how fearsome, is likely to work forever, and the consequences of its failure would be intolerable for civilization. The President's call was a direct challenge to the offensive concept of deterrence that has dominated U.S. strategic policy for decades. That concept is based upon the simple and still widely accepted argument that neither the United States nor the Soviet Union will launch a nuclear first strike or engage in other highly provocative actions if both sides are vulnerable to nuclear retaliation. The President's speech suggested that vulnerability to a Soviet nuclear attack is not an acceptable condition in the long term, and that the

[1] The full text of President Reagan's speech is in *The New York Times*, March 24, 1983, p. 20.

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United States would examine avenues to counter the threat of nuclear missiles.

Following the President's speech, National Security Study Directive 6–83 mandated an examination of the technology that could eliminate the threat posed by nuclear ballistic missiles to the security of the United States and its allies. Accordingly, between June and October 1983, two studies assessed the technical and policy issues of a national commitment to ballistic missile defense (BMD). James C. Fletcher, former administrator of the National Aeronautics and Space Administration, headed a Defensive Technologies Study Team, and Fred S. Hoffman, director of Pan Heuristics (a policy analysis organization based in Los Angeles), led an extragovernmental Future Security Strategy Study. A senior interagency group integrated the two studies, and on behalf of Secretary of Defense Caspar Weinberger and then National Security Advisor William P. Clark, recommended a technology development plan to the President. The interagency group reportedly advised a vigorous research program to support an early decision concerning BMD development and deployment options, and recommended funding estimates for Fiscal Year 1985 through FY 1989 ranging from $18 billion to $27 billion. The interagency group apparently estimated the total cost, through deployment, of a multilayered defensive system to the year 2000 at approximately $95 billion; a recent Department of Defense study, however, has placed the cost of a laser defense for U.S. cities much higher.[2]

On January 6, 1984, President Reagan reportedly signed National Security Decision Directive 119, which authorized an expansive research program to demonstrate the technical feasibility of intercepting attacking enemy missiles. The President has requested $1.99 billion for the "strategic defense initiative" for FY 1985, a level of support that is $250 million above the budget figure for FY 1984.

Although a small core of strategic defense enthusiasts has always been present within the U.S. defense community, this level of officially expressed interest in strategic defense is an unprecedented development in recent U.S. strategic policy. The goal of actively defending the American homeland in the event of nuclear conflict has not received serious official endorsement since the 1960s. Also unprecedented is the fact that the President has set policy in front of technology. If the United States does, in fact, deploy a multilayered system for defense against ballistic missiles, it will be the result

[2] Reported in *Defense Daily*, November 29, 1983, p. 137.

of policy leading technology, not the more familiar "technology creep" generating enthusiasm and a constituency for a weapons system which then "finds" a policy rationale as it is developed.

In essence, what would be involved would be a new direction in U.S. nuclear policy, a transition period of possibly two decades, involving a new and serious commitment to strategic defensive forces. Of course, such a commitment could not limit itself to countering the threat from ballistic missiles, but would also call for greatly improved capabilities to defend against strategic bomber and cruise missile threats.

Strategic defense has not been debated seriously since the anti-ballistic missile (ABM) debate of 1968–1971. Many of the technological, political and strategic factors pertinent to the old debate have changed considerably since then, but the key issues remain unchanged. They are:

—What role is ballistic missile defense expected to play;
—What effect will a commitment to strategic defense have on stability;
—What is the role of strategic offensive forces during and after a defensive transition;
—How are the European allies likely to react;
—What is Soviet policy concerning ballistic missile defense, and how is the Soviet Union likely to respond to an American initiative; and finally,
—What are the arms control implications of a defensive transition?

II

The role that strategic defense might play in U.S. national security policy is now a contentious issue. Should it be expected to provide an "astrodome" covering American military forces and cities comprehensively, or is a more limited objective acceptable, such as only defending U.S. retaliatory weapons? The criteria for defense effectiveness have profound implications for the research programs to be pursued and the types of defensive systems to be deployed.

For example, if a comprehensive defense for the American homeland is the only objective deemed worthy of the cost, then "exotic" defensive technology such as space-based, directed-energy beam systems or hypervelocity guns will be essential—technology that may take many years to mature. If, however, a more limited defensive mission is endorsed, such as the defense of U.S. retaliatory

forces against a Soviet first strike, then more conventional ground-based systems incorporating radars, infrared sensors, and rocket interceptors would be appropriate. Proponents of the "astrodome" approach fear that the diversion of attention toward less sophisticated and less effective systems could harm the chances for the deployment of any defensive forces. They feel that the promise of a comprehensive defense of cities by exotic systems and the transcending of offensive-oriented deterrence is a goal that will capture the imagination and support of the American people—support that should not be jeopardized by discussion of limited defenses for U.S. retaliatory forces.

A limited defense for U.S. retaliatory forces, however, need not be inconsistent with a future exotic defense of cities. Indeed, the two roles and systems would be highly compatible, perhaps essential to a stable defensive transition. A comprehensive BMD system would require multiple defensive layers, including conventional earth-based rocket interceptors as well as exotic beam technology. Such a system would use multiple tiers of defensive protection, intended to intercept Soviet missiles during different phases of flight: the boost and post-boost phase, early and late mid-course, and the terminal phase of flight. More or fewer defensive tiers could exist depending upon the number and types of systems deployed. The layering of defensive forces into multiple tiers of interceptors could provide an extremely capable system for defense. For example, five tiers of defensive interceptors achieving 85-percent effectiveness in each layer would reduce the overall attack to less than .01 percent of the original number of attacking weapons. If 10,000 nuclear warheads were launched at the United States with such a multilayered defensive system in place, at most a single weapon would be likely to penetrate to its target.

Current, more conventional earth-based BMD technology is relevant to the interception of warheads at various points in the mid-course and terminal phases of missile flight, but it does not promise effectiveness in the boost phase, wherein an attacking missile would be intercepted prior to releasing its host of individually targetable warheads (MIRVs). Intercept during this stage exerts great defensive leverage over the attacking force because each missile destroyed eliminates all the warheads carried by that missile.

Nevertheless, near-term BMD technology could provide the means for the important lower tiers of conventional defense designed to defend U.S. intercontinental ballistic missiles (ICBMs), strategic bomber bases, and selected critical command, control and communication facilities. These ground-based defensive systems designed

to intercept Soviet warheads in their mid-course and terminal phases of flight would likely be non-nuclear, i.e., they would not use nuclear-tipped interceptors, and could be available by late in this decade. The deployment of such near-term defenses for limited coverage would actually help to facilitate a subsequent commitment to a more comprehensive defensive system involving exotic space-based systems.

The period of transition to a comprehensive defense incorporating additional layers of more advanced defensive technology could require two decades or longer for full deployment of the systems. It must be recognized that this transition period could be dangerous if precautions were not taken to ensure political and strategic stability during that period. The Soviet Union, for example, is likely to achieve an initial temporary advantage in defensive capability given its existing extensive radar network and rapidly deployable ground-based BMD. A unilateral Soviet BMD system of even limited effectiveness could be highly destabilizing in the context of existing Soviet offensive first-strike capabilities and extensive air defense and civil defense preparations: the U.S. deterrent threat could be severely degraded by the combination of the Soviet first-strike potential to destroy American strategic nuclear forces and a Soviet defense against surviving American forces.

This combination of Soviet offensive and defensive capabilities could increase first-strike incentives during a crisis if Soviet leaders were persuaded that the U.S.S.R.'s defenses might be capable of largely absorbing the much-diminished U.S. retaliatory capability. Admittedly, Soviet strategic defenses on a modest scale could do little to limit damage against a coordinated and large-scale attack by undamaged U.S. offensive forces; but alerted Soviet defenses could be very effective in defending against a U.S. force sharply reduced in size and impaired by a Soviet first strike.

Thus, early deployment by the United States of a ballistic missile defense for its retaliatory forces would not only help to ensure the survival of U.S. strategic weapons, but would also assist in preserving the credibility of the U.S. offensive deterrent during an otherwise potentially unstable transition period. Even such limited conventional defensive coverage for U.S. retaliatory forces would create enormous uncertainties for Soviet planners considering the effectiveness of a strategic first strike, in addition to those longstanding doubts pertaining to the calculated effectiveness of their offen-

sive forces.[3] In the context of Soviet defensive deployments, enhancing the survivability and potential effectiveness of U.S. retaliatory forces by means of both strategic defense and more immediate special "penetration aids" for offensive weapons would help to ensure that a transition to a comprehensive defensive capability could be pursued safely.

The crucial role played by U.S. retaliatory forces to safeguard stability during the initial phase of a defensive transition should also be clear. MX-Peacekeeper intercontinental ballistic missiles, a new small ICBM, B-1B bombers, cruise missiles, and Trident submarines are essential for deterrence stability during the decades of transition. New defensive weapons should not be considered a substitute for, or alternative to, the current modernization of strategic offensive forces; indeed, a strategic defensive initiative necessitates modernization of offensive forces to help sustain stability during the defensive transition. The leaders of the Soviet Union are likely to share this view.

Finally, a transition to a comprehensive defense for the American homeland would require the support of many Administrations and necessitate major technological advances. Completion of such a transition could be waylaid for technological or political reasons over the course of the decades that any such transition will require. As a result, each phase of a defensive transition must be valuable in and of itself, and should complement any subsequent investment in strategic defense. Early deployment of BMD coverage for U.S. retaliatory forces would constitute the first phase of a comprehensive defensive transition; it would safeguard the process of transition, and would be strategically valuable on its own merits, even if subsequent phases were delayed or terminated for political or technical reasons.

An important by-product of a ballistic missile defense system, even of limited effectiveness, is protection of the United States (and Soviet Union) from the accidental launch of a missile. For both sides to be protected against an accident would be far preferable to the current condition which carries a very high risk that disastrous consequences would follow from any such mishap. Further, limited BMD could help protect the United States against lightly armed nuclear powers of the future.

[3] For example, a "light" area defense should be capable of defeating Soviet precursor attacks against the U.S. strategic command and control systems and of denying the Soviet Union the option of pinning down U.S. ICBMs in their silos so that they could not launch under attack. On the technical uncertainties for the offense, even in the absence of ballistic missile defenses, see Matthew Bunn and Kosta Tsipis, "The Uncertainties of a Preemptive Nuclear Attack," *Scientific American*, November 1983, pp. 38–47.

There are dozens of technical possibilities for future strategic defense systems; the debate over the proposed defense transition is not about the prospective effectiveness of one or two systems. Faced with the very rich menu of technical options for defense, it is simply untenable to assert that "they" (ground-based conventional interceptors and beam weapons, and space-based or deployable directed- and kinetic-energy weapons) will not work. Very near-term technology almost certainly could effectively provide limited but important defensive coverage for U.S. strategic forces.[4]

The more sophisticated exotic technology necessary for a comprehensive defense, although still in its infancy in some regards, shows tremendous potential. Commenting upon the recent classified governmental studies reviewing BMD, the President's Science Advisor, Dr. George Keyworth, noted:

> We can now project the technology—even though it hasn't been demonstrated yet—to develop a defense system that could drastically reduce the threat of attack by nuclear weapons, not only today, but those that could reasonably be expected to be developed to counter such a defense system.[5]

All of recorded history has shown swings in the pendulum of technical advantage between offense and defense. For the strategic defense to achieve a very marked superiority over the offense over the next several decades would be an extraordinary trend in the light of the last 30 years, but not of the last hundred or thousand years. Military history is replete with examples of defensive technology and tactics dominating the offense.

In sum, different levels of defensive technology can make important, and distinct, contributions to strategic stability. The near-term role for limited ballistic missile defense suitable to the technology likely to be available soon would be to provide protection for the U.S. nuclear deterrent and perhaps protection of the nation against small or accidental attacks. As the initial phase in a transition to comprehensive BMD coverage, defense of U.S. retaliatory forces would help provide the stability necessary for the long-term development of the more effective systems needed for a comprehensive defense of U.S. cities. If the technology for effective city defense proves to be attainable, then strategic defense can expand in scope and depth to provide coverage for urban and industrial America.

[4] For an excellent technical discussion that supports this claim, see Dr. Patrick Friel, "Status of U.S. BMD Technology," a paper presented to the annual conference of the American Association for the Advancement of Science, Washington, D.C., January 6, 1982. See also William Davis, "Ballistic Missile Defense Will Work," *National Defense*, Vol. 66, No. 373, December 1981, p. 16.

[5] Quoted in "Keyworth: Space-Based Defense Possible," *Air Force Times*, October 31, 1983, p. 29.

If so, the limited coverage provided by earlier conventional ballistic missile defense will still be valuable, indeed essential, as a backstop against "leakage" through space-based tiers of defense.

III

What is the likely effect of strategic defense on stability? If the Reagan Administration (or its successors) cannot answer critics who charge that strategic defense would be "destabilizing," it will have little hope of generating or sustaining the necessary congressional and public support. During the initial phase of a defensive transition, stability could be safeguarded by defending U.S. offensive forces and by enhancing their potential to penetrate Soviet ballistic missile defenses.

A more difficult question concerns how stability would be maintained during the later phases of a transition wherein, theoretically, neither side could pose a credible threat to inflict very widespread nuclear destruction upon the other's homeland. Deterrence in the nuclear age has come to be understood in terms of mutual threats of nuclear devastation varying only in kinds of targets, i.e., counter-military, counter-industrial, counter-city, or all of these. The nuclear missile age has so far been an age of defenselessness against these threats. The question now is: could stability be maintained if the current condition of mutual homeland vulnerability were to be altered drastically?

Before addressing this question, it should be noted that neither the United States nor the Soviet Union could have complete confidence in their defensive systems. Exotic defensive systems could fail catastrophically under actual operational conditions. Very sophisticated systems, which must integrate numerous and complex component functions in the face of countermeasures, entail a degree of uncertainty. This uncertainty concerning the operational effectiveness of the total system could persuade leaders of both superpowers that an "unacceptable" level of destruction could still result from a clash of arms. The prospect of a catastrophic failure of the defense, or substantial leakage, should serve as a residual offensive deterrent. It certainly should preclude the possibility that any political leader would believe that the world had been rendered completely "safe" for large-scale non-nuclear war.

If, however, one assumes a very high degree of confidence by U.S. and Soviet leaders in their defensive systems, deterrence should still function, but it would no longer be the long-familiar deterrence from mutual vulnerability. The U.S. deterrent would rest on a defensive capability to deny plausibility to any Soviet

"theory of victory." That is, U.S. defenses would thwart Soviet strategy and deny the Soviet Union its requirements for military and political success. These include: the destruction of U.S. military potential such that the Soviet Union, though not escaping damage in nuclear war, would survive, recover, and continue to function; the destruction of opposing forces in Europe; and the seizure of critical strategic assets world-wide.[8] Soviet military writers caution against any nuclear "adventurism" in the absence of a capability to meet these requirements for success.

This type of defensive deterrent is not totally removed from the current offensive-oriented deterrent. Currently the United States seeks to deny the Soviet Union its theory of victory by promising a devastating nuclear retaliation. In contrast, a defensive deterrent would deny the Soviet Union its theory of victory by ensuring its inability to defeat the United States—promising a long and potentially unwinnable war which could allow the vastly superior U.S., and U.S.-allied, military-industrial potential to come into play. Soviet leaders are acutely sensitive to the probable negative political consequences of such wars and are highly respectful of U.S. military-industrial potential. The prospect of waging a protracted war would be a deterring prospect for Soviet leaders. Perhaps most important, unlike the current condition, a defensive deterrent would combine the prospect for denial of Soviet victory with the avoidance of U.S. defeat and destruction.

It is difficult to compare the relative efficacy of offensive and defensive approaches to deterrence. The current offensive-oriented deterrent threatens dire short-term consequences, but its credibility is subject to grave doubt. Would an American President actually invite national self-destruction by unleashing U.S. nuclear forces in response to a limited Soviet attack (against U.S. allies perhaps), thereby triggering massive Soviet nuclear retaliation? Some reply with a cautious "yes," others with a skeptical "no." The point is that no matter how the United States refines its offensive-oriented nuclear strategy, it is apparent that American society could not withstand Soviet nuclear retaliation. Consequently, a solely offensive-oriented deterrent must lack credibility vis-à-vis most threats; its effectiveness is extremely constrained.

A defensive-oriented deterrent would not impose comparably dire short-term punishment, but there would be no doubt concerning the credibility of a defensive deterrent being used. Just as no

[8] For an examination of Soviet victory requirements, see John Dziak, *Soviet Perceptions of Military Doctrine and Military Power: The Interaction of Theory and Practice*, New York: National Strategy Information Center, 1981, p. 28.

one questions whether NATO's conventional forces would fight if attacked, so there should be no question that strategic defenses would be used, particularly if they were of a non-nuclear kind. It is a matter of no small importance to have forces whose credibility of employment is 100 percent. While it is difficult to compare the relative efficacy of these different types of deterrents, there is one critically important distinction. In the event deterrence fails, extremely effective defenses could enable the United States (and perhaps the Soviet Union) to avoid a nuclear holocaust, while a purely offensive approach to deterrence virtually ensures a holocaust.[7]

In short, a transition to strategic defense would not be inconsistent with deterrence. Rather it would introduce a different approach to deterrence, an approach that could reduce both the probability and the consequences of nuclear war.

IV

A defensive deterrent would thus present powerful disincentives against a Soviet nuclear first strike. It is likely, however, to be less appropriate for the current policy of extending deterrence coverage to allies and global interests. The U.S. strategic nuclear threat, which is integral to NATO's "flexible response" doctrine, would be less deterring in the presence of Soviet strategic defenses. Moreover, the Soviet Union might believe that the potential benefits of conventional conquest in Europe or the Persian Gulf would be worth the risk if there were a strategic defensive stalemate with the United States. Indeed, control and exploitation of the industrial and energy resources of Western Europe and the Gulf may be seen by Soviet leaders as the way of overcoming their otherwise long-term structural economic disadvantages in the global competition with the United States, notably in the production of military high-technology items.

A possible solution to this potential problem is the same as that suggested for the solution to NATO's current over-reliance upon the threat of nuclear retaliation, namely the enhancement of NATO's conventional forces. That solution has been understood and advocated by every U.S. Administration for the past two decades. The European allies, however, have long resisted incurring the social and economic costs associated with providing NATO with conventional forces sufficiently large, well equipped, and intelligently

[7] The qualifier, "virtually," acknowledges the presence of the existing theory of damage control and limitation. To be specific, damage to the American homeland in war might be limited if the Soviet government chose to exercise restraint in its nuclear targeting.

deployed to compel the Soviet Union to think in terms of a high-risk, high-cost nuclear attack. Instead, NATO Europe has preferred for years to rely heavily on a largely U.S.-provided nuclear deterrent. Should, however, the Soviets develop an effective strategic defense, the U.S. "nuclear umbrella" would appear much less fearsome to the U.S.S.R., compelling Western Europeans to seek an alternate means of preserving their security.

Thus, it is doubtful that America's European allies will ever be enthusiastic about a defensive transition in U.S. national security policy. They are likely to see it as a weakening of the U.S. commitment to provide a nuclear umbrella over Western Europe. Moreover, European countries confront a wider spectrum of threat than does the United States. A BMD system that effectively protected the United States *and* its European allies from strategic nuclear attack would still leave the Europeans vulnerable to conventional and some kinds of tactical nuclear attack. This asymmetry in vulnerability, and hence the perception of an asymmetry in American and European interests, could be exacerbated by a new U.S. defensive deterrence policy.

A defensive transition by both superpowers would also degrade, perhaps nullify, the British and French independent strategic deterrents. It was clear during the SALT I negotiations that the British and French wanted BMD limited to very low levels so that their relatively small independent nuclear forces would retain effectiveness. There is little to indicate that the British or French have a different perspective today.[8]

During a defensive transition, however, some of the allies might seek to parallel U.S. and Soviet efforts and acquire their own strategic defenses. French President François Mitterrand apparently indicated interest in strategic defense when he recently stated that a "European space community" with the capability "to fire projectiles that would travel at the speed of light" would "be the most appropriate answer to the military realities of the future."[9] The British and French may also adopt a more aggressive "penetration aids" program for their offensive nuclear forces to enhance their effectiveness against Soviet defenses. In the near- to mid-term, however, it would seem unlikely that independent European offen-

[8] See for example the discussion in Lawrence Freedman, "The Small Nuclear Powers," in *Ballistic Missile Defense*, Ashton B. Carter and David N. Schwartz, eds., Washington: The Brookings Institution, 1984, pp. 151–174.

[9] Remarks by President François Mitterrand at a luncheon offered by the Council of Ministers of the Kingdom of The Netherlands, The Hague, February 7, 1984. Embassy of France, Press and Information Service, Memo 84/6, p. 8.

sive or defensive capabilities could compete successfully with those of Soviet forces.

On an objective analysis, there are some respects in which a defensive transition could enhance security in Europe. First, U.S. BMD technologies could help protect the Western Europeans from Soviet long-range theater nuclear weapons (such as SS-4s, SS-5s, SS-20s, and variable-range ICBMs and submarine-launched ballistic missiles or SLBMs). Given the relative ease of Soviet military access to Western Europe, such a defense would not be comprehensive, but it certainly could reduce NATO Europe's vulnerability significantly and provide a politically effective counter to the much discussed SS-20.

Second, if America is defended, the President is likely to see a lower level of risk involved in responding to a Soviet invasion of Europe than if America were naked to Soviet nuclear attack. This fact alone should significantly reduce any Soviet inclination to attack NATO Europe. Even though the United States could not pose an "assured destruction" level of threat against the Soviet Union in response to an invasion of NATO Europe,[10] the prospect of waging a long war for control of Europe with a defended and mobilized America could not help but be a highly deterring prospect. Thus, the U.S. "extended deterrent" over Europe could still be effective to an important degree.

Nonetheless, the reaction of major NATO countries to a U.S. BMD program would be likely to reflect the concerns already noted, as well as a fundamental difference between American and European perspectives on security. NATO allies have long criticized what they identify as the U.S. penchant for a technological rather than a political solution to security concerns. No matter how sound the strategic case for a defensive transition, many Europeans will be more impressed by the effect a defensive transition might have on the political foundations of the familiar East-West security system.

In sum, many Europeans are likely to prefer what they judge to be the political benefits of détente and an intact ABM Treaty to the strategic benefits that would follow a transition to effective strategic defenses. Ultimately the United States may have to decide whether concessions to the concerns of its allies about strategic defense are

[10] This assertion rests on the assumption that Soviet technical prowess in BMD is roughly equivalent to postulated U.S. prowess. Given the respective strengths of the superpowers as competitors in the area of military high technology, it is very possible that U.S. BMD will be significantly better than will Soviet BMD. Our argument does *not* require for its validity that the U.S. achieve and sustain a lead in defensive systems. But such a lead would have beneficial consequences for strategic stability.

worth the price of forgoing the potential for a comprehensive defense and leaving the American homeland vulnerable.

V

How would the Soviet Union respond to an American defensive transition? Would the Soviet Union cooperate, tacitly or explicitly, with a defensive transition, by negotiated reductions in offensive weapons to ease the defense burden, or would it choose to compete comprehensively in an offense-defense race?

First, it should be noted that the Soviet Union has exhibited much more enthusiasm for strategic defense over the past two decades than has the United States. Soviet "strategic defensive activities were roughly five times U.S. outlays in 1970 and increased to 25 times U.S. outlays in 1979.[11] While the United States drastically reduced its number of interceptor aircraft and de-activated its air defense, surface-to-air missile (SAM) batteries during the 1960s (on the argument that if defense against ballistic missiles was infeasible, there was little point in bomber defense), the Soviet Union modernized and increased its air defenses. While the United States reduced its commitment to civil defense to a marginal level, the Soviet Union expanded its civil defense efforts. Additionally, Soviet offensive-force modernization over the last decade has been directed toward achieving the capability to destroy U.S. retaliatory forces before they could be used—"active defense" in Soviet military parlance. It is apparent that the notion of defending the homeland is central to Soviet strategic thinking.

The Soviet Union has approached ballistic missile defense through two avenues. First, the Soviet Union has maintained, and is now modernizing, the world's only operational ballistic missile defense site around Moscow. Moreover, it has continued to upgrade its extensive network of air defense radars and interceptors (such as the SA-5 and SA-12 interceptors), giving them some capability against strategic ballistic missiles and intermediate-range theater nuclear missiles such as the Pershing II. The United States tried to address this possibility by including articles in the 1972 ABM Treaty prohibiting the testing of air defense components "in an ABM mode." This is a key area where the Soviet Union is alleged to have violated the letter and the spirit of the ABM Treaty by testing air defense radars and interceptors against ICBMs. Recently, U.S. photo reconnaissance satellites discovered a new, gigantic radar under

[11] Central Intelligence Agency, National Foreign Assessment Center, *Soviet and U.S. Defense Activities, 1970–1979: A Dollar Cost Comparison*, SR–80–10005, January 1980, p. 9.

construction near Abalakova that is difficult to explain except as an ABM battle management facility. The location (far from the Soviet periphery) and the direction of this radar appear to be in direct violation of the ABM Treaty.

Second, the evolving Soviet ballistic missile defense research and development program accommodates directed-energy beam systems and a more conventional BMD system involving transportable radars and high- and low-altitude interceptors that could be deployed rapidly.[12] The combination of an existing infrastructure of large battle management radars, rapidly deployable BMD interceptors, and transportable missile site radars has led some in the intelligence community to conclude either that the Soviet Union is preparing to "break out" of ABM Treaty constraints and initiate a defensive transition, or is engaged in a "creeping" break-out, to be followed by rapid deployment of BMD.

Yet there are several reasons why it is unlikely that the Soviet Union would be the first to withdraw formally from the ABM Treaty and initiate an overt transition to ballistic missile defense. While the Treaty is in effect, the Soviet Union can continue to pursue its gradual upgrading of air defense to achieve greater ballistic missile defense capability, with less likelihood that the United States will react strongly. This sub-rosa avenue to greater strategic defense would permit the Soviet Union to avoid the political fallout and frantic U.S. response that would probably result from outright Soviet renunciation of the ABM Treaty.

Second, the Soviet Union obviously is aware that for the first time in two decades the United States is making a very serious commitment to explore the technical promise of strategic defense. Soviet leaders may suspect that the United States will petition for revision or withdrawal from the ABM Treaty within the decade. A prudent tactic for the Soviet Union would be to wait for such a U.S. initiative, and then to insist on significant U.S. arms control concessions in return for Soviet endorsement of the revisions sought by the United States. In this case the Soviet Union could achieve a major propaganda success with the charge that it was the United States that had sought to weaken or terminate this important symbol of détente, indeed, this perceived monument to the mutual commitment to prevent nuclear war. Given the enduring West European commitment to 1970s-vintage détente, the Soviet Union could

[12] For an excellent review of Soviet BMD activities see Sayre Stevens, "The Soviet BMD Program," in *Ballistic Missile Defense*, *op. cit.*, pp. 182–220. See also Department of Defense, *Soviet Military Power*, Washington: GPO, 1983, pp. 27–28, 68.

further its traditional objective of dividing NATO by presenting itself as the defender of the ABM Treaty.

Finally, if the Soviet Union should "break out" of the ABM Treaty in the near term, it is almost certain that the United States would respond with deployment of a system based upon current defensive technology. U.S. ballistic missile defense research and development has focused upon ICBM defense for almost two decades, and it is clear that the defense of ICBM silos is within our grasp. The Soviet Union, however, has spent billions of rubles deploying its fourth-generation ICBMs (particularly the SS-18s and SS-19s) for the purpose of putting U.S. ICBM silos at risk. It also is quite clear that the Soviet Union signed the ABM Treaty substantially in order to forestall the potential of the U.S. Safeguard missile defense program, then under deployment to protect U.S. ICBMs from attack. In effect, the ABM Treaty provided Soviet SS-18s and SS-19s unimpeded access to U.S. ICBM silos. With MX-Peacekeeper ICBMs scheduled to go into silos in 1986, it seems unlikely that the Soviet Union would choose to surrender its ability to threaten U.S. ICBMs by abrogating the ABM Treaty. Such a course of action would be reasonable only if the Soviet Union were very confident in the ability of its defenses to intercept U.S. ICBM warheads. In that case, the Soviet Union would not have to rely on its offensive forces to destroy U.S. retaliatory forces and would need to be far less concerned about a U.S. capability to defend its ICBMs.

Given all of these considerations, it would appear unwise for the Soviet Union overtly to break out of the ABM Treaty regime. What then would be the likely Soviet responses to a U.S. defensive initiative? Our judgment is that the Soviet Union would be most likely to pursue a dual-track response—combining arms control and diplomatic initiatives with strong military programs. Such behavior would be in keeping with the traditional Soviet proclivity for pursuing arms control negotiations and a dynamic arms buildup simultaneously.

Specifically (assuming that the United States had gone ahead), the Soviet Union is likely to attempt both to deploy its own BMD systems and to provide effective countermeasures for its offensive forces in order to thwart U.S. defensive systems. If the Soviet Union seeks to maintain its nuclear threat against the United States and to provide strategic missile defense for its homeland, then an effort to provide offensive countermeasures to U.S. defenses is inevitable. If the Soviet Union were able to achieve the capability to nullify the U.S. retaliatory deterrent while maintaining its own offensive threat against the United States, it would have achieved a strategic

condition of major military advantage. The United States obviously must guard against such a condition.

Some of the potential Soviet countermeasures include: an attempt to prevent the United States from deploying defensive weapons in space through direct military interdiction; an increase in the number of offensive weapons sufficient to saturate the U.S. defense; and passive protection of Soviet offensive forces to ensure penetration of U.S. defenses.

The first of these options is the least likely, given the risks involved in initiating a war of attrition in space, particularly if the Soviet Union hopes to deploy its own space-based defenses. The Soviet Union historically has not taken direct action in response to U.S. deployment of a new type of military system. A basic precept of Soviet policy is that war is a political phenomenon; it is not a proper response to an American peacetime weapons deployment.

Among offensive and defensive military countermeasures, the Soviet Union might attempt to increase its number of ICBM and SLBM warheads, intending thereby to saturate the U.S. defensive systems. A second tactic would be to attempt to sidestep U.S. defenses against ballistic missiles by increasing the bomber and cruise missile threat. The Soviet Union could also attempt to avoid all U.S. strategic defenses by emphasizing "unconventional" operations (e.g., crisis and wartime sabotage) involving nuclear, chemical or biological weapons.

Finally, the Soviet Union could attempt to provide "passive" protection for its offensive forces against U.S. defensive beam weapons. This could be done, for example, by hardening the missiles, increasing their speed of ascent and thereby reducing their time at maximum risk, adding ablative material to missiles so as to absorb the heat transferred by a high-energy laser beam, or even by spinning the missile during its ascent in order to reduce the dwell time of the laser beam.

If the Soviet Union lacked confidence that it could succeed in this high-technology competition, however, it would have greater incentives to pursue constraints on the United States through arms control. The ABM Treaty is an informative precedent. During the early 1970s the Soviet Union chose to limit U.S. superiority in ABM technology through arms control rather than by relying upon offensive countermeasures alone.

VI

This brings us to the question of the impact on arms control of a determined U.S. BMD program and of the likely Soviet response to

such a program. Here the first question is the impact on existing arms control agreements, notably the ABM Treaty.

The United States and Soviet Union would have to revise the ABM Treaty to permit deployment of BMD systems of even limited effectiveness. A comprehensive defense would likely necessitate withdrawal from the Treaty, which Article XV permits on six months' notice.

The United States certainly has sound strategic and arms control reasons to reconsider its continued endorsement of the ABM Treaty. At the time the Treaty was signed, the United States established a clear linkage between offensive and defensive arms control limitations. Such a linkage made good sense; the United States could accept severe constraints on BMD, which might defend U.S. ICBMs and strategic bomber bases, if the Soviet offensive threat to U.S. retaliatory forces could be constrained and reduced on a long-term basis through arms control.

Thus, U.S. Unilateral Statement A, accompanying the ABM Treaty, stated specifically that a failure to achieve agreement within five years, providing for more comprehensive limitations on offensive forces than those contained in SALT I, could be grounds for withdrawal from the ABM Treaty. Unilateral Statement A also said: "The U.S. Delegation believes that an objective of the follow-on negotiations should be to constrain and reduce on a long-term basis threats to the survivability of our respective strategic retaliatory forces."[13]

Unfortunately the standard thus set by the United States for continued support of the ABM Treaty has not been met. Indeed, the Soviet offensive threat to U.S. retaliatory forces has increased dramatically since the signing of SALT I, and the signed but unratified SALT II agreement would not have eased the problem of strategic force vulnerability given the types and numbers of weapons permitted.

Yet the strict prohibitions on BMD systems that could defend retaliatory forces remain intact in the form of the ABM Treaty. Since the signing of SALT I, the United States has, to a large degree, dismissed the sensible linkage between offensive and defensive limitations established at those negotiations.

Thus, the United States and the Soviet Union do have the legal right to withdraw from the ABM Treaty, given proper notice, and the United States does have a strategic and an arms control rationale

[13] See U.S. Arms Control and Disarmament Agency, *Arms Control and Disarmament Agreements: Texts and Histories of Negotiations*, Washington: GPO, 1980, p. 146.

for reconsidering the ABM Treaty. The Treaty should not be considered sacrosanct.

If the United States does decide to seek revisions to, or withdraw from, the ABM Treaty to permit extensive deployment of BMD, when would a change in the status of the Treaty be necessary? It is unlikely that revision or withdrawal would be required until relatively late in the 1980s. This is because the ABM Treaty constrains deployment much more severely than it does research and development.

The potential near-term BMD system that could provide limited but important defensive coverage during the initial phase of transition could run into trouble with the Treaty prohibition against testing, development or deployment of mobile BMD components (Article V); certainly actual deployment of any effective system would run afoul of the limitations of Article III, which restrict the number of permitted sites to two (amended to one site in the 1974 ABM Treaty Protocol) and the number of permitted interceptors and launchers to 100.

Although mobility would probably be sought in a near-term BMD system, to ensure survivability, the initial development and testing of subsystems need not be in a mobile mode, and the actual mating of these subsystems to constitute a mobile component or system need not occur until relatively late in the development and testing process. Thus there is no great urgency to revise the Treaty in the very near future. If the United States decides to proceed with the defensive transition, however, it should begin to examine the types of treaty revisions that are necessary, and the appropriate timing for those revisions.

The Treaty does allow great freedom for development and testing (but not deployment) of exotic beam defenses, particularly as long as these are tested from fixed, ground-based installations. Nevertheless, in the long run, if the United States decides to pursue comprehensive BMD coverage using multiple layers of defensive interceptors, the ABM Treaty will be unlikely to survive in anything resembling its current form.

On the other hand, neither the prospective near-term defensive systems considered here, nor later more sophisticated defenses, would require atmospheric testing of nuclear weapons.[14] Most of

[14] Presidential Science Advisor George Keyworth recently observed that there does not appear to be an important role for nuclear weapons involved in the transition to strategic defense. This comment was made during Dr. Keyworth's presentation at the Forum on The Future of Ballistic Missile Defense, Brookings Institution, February 29, 1984. His statement appears to be an authoritative refutation of the notion that a nuclear-pumped X-ray laser system would be a critical component.

the technologies under consideration are non-nuclear and would not involve space-based "weapons of mass destruction" (i.e., nuclear, chemical or biological). Hence a defensive transition need not run afoul of either the Limited Test Ban Treaty of 1963 or the Outer Space Treaty of 1967, banning such weapons.

In sum, a defensive transition would compel initial revision and in all probability later withdrawal from the ABM Treaty. This could be done legally, and would not be inconsistent with the U.S. arms control position established at SALT I. But the most basic question is its broader impact on arms control efforts, particularly to limit offensive weapons on both sides.

In this broader context, there are several reasons why defense and arms control could be mutually beneficial. A defensive transition could establish a necessary basis for deep offensive force level reductions. First, even limited near-term defense systems designed to protect retaliatory forces could alleviate the verification difficulties associated with deep force level reductions. At current relatively high force levels a degree of ambiguity in the ability to verify an agreement is considered acceptable because only large-scale violations would have a "significant" impact upon the strategic balance, and such violations are likely to be noticed. Reducing U.S. and Soviet strategic arsenals to the level initially proposed by the United States at START (e.g., reportedly, a ceiling of 850 for deployed ballistic missiles) or lower, however, would place a higher premium on each delivery system. At much lower force levels even a relatively small level of noncompliance could have a significant impact upon the strategic balance, and thus be of great concern.

In the context of small numbers of U.S. retaliatory forces, the covert retention or deployment of even a few MIRVed ICBMs could be a threat to the survivability of an important fraction of U.S. deterrent forces, and thus provide the Soviet Union with an increased incentive to strike first. And the importance of very strict verification for deep reductions is incongruous with the increasing difficulty of totally monitoring the deployment of new types of nuclear weapons such as cruise missiles and mobile ballistic missiles. Consequently, in the absence of a defensive transition the U.S. insistence upon the ability to verify an agreement with very high confidence could reduce the chance for any deep arms reductions. A transition to strategic defense, however, would reestablish the condition wherein deception on a very large scale would be necessary before the strategic balance could be jeopardized by cheating. U.S. retaliatory forces that were defended would be less vulnerable

to deceptively deployed Soviet forces—hence the need for very rigorous verification standards could be somewhat relaxed.

Second, it is clear that one reason for the Soviet commitment to large numbers of strategic weapons is to achieve a damage-limiting effect through offensive "counterforce" capabilities, i.e., the ability to disrupt U.S. command channels and to destroy U.S. retaliatory forces before they could be launched against the Soviet Union. It is likely that the Soviet Union has been so reluctant to agree to U.S. proposals for deep reductions in heavy MIRVed ICBMs because these weapons are the primary counterforce instruments in the Soviet arsenal. As noted above, damage limitation for national survival is a key objective of Soviet strategic doctrine, and that objective currently is pursued primarily through offensive counterforce preparations.

A defensive transition could provide the damage-limiting capability mandated by Soviet doctrine, with strategic defense replacing offensive forces as the principal means for limiting damage. Strategic defense could, in effect, take over the damage-limitation mission now given to offensive counterforce weapons. Such a development should reduce the long-noted reluctance of the Soviet Union to accept negotiated cuts in its large ICBM force.

Finally, if defensive technology proves to be extremely effective, it could reduce the incentives for the offensive arms competition by rendering it futile. The Soviet ballistic missile defense program of the 1960s probably was truncated because it became apparent that U.S. advances in MIRV technology would easily counter the Soviet defensive system. Thus, U.S. technological advances in offensive systems probably discouraged the Soviets from continuing to deploy what had become obsolete defensive technology. The development of highly effective defensive technology could, and logically should, have a similar impact upon offensive weapons programs.

Of course, a transition to defense could lead to a competition in the development and deployment of increasingly advanced defensive technologies. Nevertheless, restructuring the arms competition toward a "defense race" would have a benign impact upon the catastrophic potential of nuclear war, and would be far preferable to an indefinite continuation of the competition in offensive nuclear arms.

## VII

In one other respect, related to arms control, a defensive transition could serve the interest of all mankind in a critically important

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fashion. A recent study on the "Global Consequences of Nuclear War" indicates that a relatively "small" nuclear war, involving between 500 and 2,000 detonations, could result in climatic changes that would trigger a global catastrophe.[15] That number of detonations would reflect the use of only a small fraction of the nuclear weapons in U.S. and Soviet arsenals. Strategic defense is the only candidate answer to this potential threat to humanity. Suggested alternatives simply are ineffective.

The most obvious and effective solution to this danger would be for nuclear weapons never to be used. However, it simply is not within the power of a U.S. President to determine whether a nuclear war will occur. Despite the best efforts of the United States to avoid nuclear war, the Soviet Union or another nuclear-armed country could employ nuclear weapons against the United States or a local foe. The first step in understanding this issue is to recognize that whatever the United States does, or does not do, cannot ensure the prevention of nuclear war. It is beyond reason to believe that all nuclear-armed powers would agree to ban the use of nuclear weapons and abide by that agreement under all conditions.

Equally incredible is the prospect for arms control to reduce the global arsenal of over 50,000 nuclear weapons to numbers below the threshold reportedly necessary to cause a climatic catastrophe. This does not mean that the arms control process has no value for the U.S. pursuit of strategic stability. Rather, what is suggested is that this avenue can hardly be relied on to prevent a climatic catastrophe that might stem from even a "small" nuclear exchange.

In sum, a defensive emphasis and nuclear disarmament are essential allies. Advocates of a radical scale of nuclear disarmament need to appreciate that truly deep reductions in offensive nuclear arsenals would be feasible only in the event of heavy deployment of strategic defensive systems. The United States could never verify strict Soviet compliance with a possible START regime that mandated reductions in offensive forces down to the low hundreds of weapons. But, with strategic defenses deployed, the superpowers could be confident that cheating would have to be conducted on a massive scale before it could provide a capability sufficient to yield important military or political advantage. If we assume that the United States and the Soviet Union will be political rivals for many years into the future, strategic defenses offer the *only* path to a nuclear disarmament agreement with which both parties could live.

A defensive transition—particularly one including the global

[15] See Carl Sagan, "Nuclear War and Climatic Catastrophe," *Foreign Affairs*, Winter 1983/84, pp. 257–292.

coverage that space-based systems or components could provide—would reduce the risk of a global climatic catastrophe by intercepting nuclear weapons after they are launched. Given the fact that nuclear deterrence can never provide the certainty of stability, and given the reported possibility of climatic disaster resulting even from the limited use of nuclear weapoons, transition to a defense-dominant strategic policy should be seen as a moral imperative. At the very least, given the perils of the arms competition in offensive systems, the United States is obligated to seek to alleviate those perils through defense. Success in this venture is not guaranteed, but there would seem to be no excuse for the United States not making the attempt.

VIII

Whether defensive technology will be sufficiently robust to defeat potential active and passive countermeasures is an important issue, one which must be examined before critical decisions concerning development and deployment of potential defensive systems can be made. The preliminary conclusions in this regard, drawn from the recent official reviews of BMD, are quite optimistic about the potential for a robust defense against ballistic missiles. Ultimately, only time and further advanced investigation into the potential for defensive technology and offensive countermeasures will enable us to conclude whether the defense will become again the stronger form of warfare.

Unfortunately, though not unexpectedly, the debate that is shaping up promises to be yet another stale and unimaginative confrontation between those who judge homeland defense to be destabilizing and those who do not. Neither the government nor private commentators are well equipped at present with an understanding of how offense and defense can proceed together in complementary, synergistic fashion for the benefit of more stable deterrence. It is very desirable that those who are strongly committed to President Reagan's vision of an America defended against ballistic missile threats think constructively about the positive roles that U.S. offensive and near-term defensive forces can play both to safeguard the defensive transition and, perhaps, to help stabilize deterrence beyond the transition.

Neither superpower, at least in the early stages of an essentially competitive defense transition, is going to cooperate tacitly in assisting the defenses of the other side to achieve high effectiveness. The United States and Soviet Union have, after all, been involved in an arms competition expressing deep-rooted political rivalry. No

matter how great the technical success of U.S. and Soviet defense transitions, the competition between offense and defense will not stop. Neither superpower is likely to abandon permanently all hope of gaining a major advantage by developing both effective offensive and defensive weapons.

One must assume that both the Soviet Union and the United States prefer a condition wherein *both* their offensive *and* their defensive capabilities are effective, to a condition wherein only their defensive weapons can perform as intended. Neither side, however, is likely to anticipate an enduring advantage in strategic offensive and defensive systems; both will be constrained to accept much more limited offensive targeting capabilities than now exist. Future missions for U.S. strategic offensive forces may include the following: guarding the defense transition; holding at risk so many high-value assets of the Soviet state that the Soviet leaders perceive a substantial net advantage in negotiating a major bilateral drawdown in offensive forces (thereby assisting the U.S. defense transition); providing an enduring hedge against sudden revelation of weaknesses in defensive systems; and providing some deterrent effect in order to help discourage gross misbehavior by third parties.

The public debate over the orientation of future U.S. strategic policy that was triggered by President Reagan's defense initiative proposal of March 23, 1983, has revealed all too plainly that there are more and less sensible ways to think about defense.

Strategic defense should not be viewed in terms of an all-or-nothing "astrodome." "Star wars" defenses, no matter how great their promise, will not constitute the last move in high-technology arms competition, and strategic defensive technology will not solve the fundamental problems of political rivalry. But strategic defense, embracing a wide range of near-term and far-term weaponry, promises to strengthen the stability of deterrence by imposing major new uncertainties upon any potential attack. In the long run, it holds out the possibility of transforming, though not transcending, the Soviet-American deterrence relationship.

Senator WARNER. Thank you.
Dr. Garwin?

## STATEMENT OF DR. RICHARD GARWIN, IBM FELLOW, THOMAS J. WATSON RESEARCH CENTER

Dr. GARWIN. Thank you for the opportunity to present my views on President Reagan's Strategic Defense Initiative.

If I may submit the prepared testimony for the record and sketch the outline in order that I may participate in some of the discussion.

I have long assisted U.S. administrations in understanding and improving the technical aspect of strategic military capability, both offensive and defensive, and that includes directed energy weapons of various types.

I was a member of the nine-person study panel responsible for the March 1984 report by the Union of Concerned Scientists, referred to previously, and that report will be part of a process of responsible technical interchange which will result in better information for the public and the Congress and even the administration.

### UNCERTAINTY OF GOAL

The problem with the Strategic Defense Initiative is not a lock of interesting things to do. It is a confusion as to goal and overemphasis on technology. The ancients summarized it, "Having lost sight of our goal, we redoubled our efforts."

It is my understanding that President Reagan is clearly not talking about defense of missile silos. He was talking about rendering all nuclear weapons impotent and obsolete.

As recently as 1 month ago Secretary Weinberger said:

> There has not been any change in direction or change in the ultimate goal. * * * The idea is to have a concentration on a thoroughly reliable, effective defense against these nuclear weapons. And it is, I think, something that can be achieved.

Secretary Weinberger is talking about all nuclear weapons, not just ballistic missiles.

But testimony from Under Secretary of Defense DeLauer and others does not support any promise of a totally effective defense of our Nation and our allies. Those working on the program scoff at the idea of an astrodome defense or defense of whole cities and their populations. They speak instead of introducing uncertainty in Soviet attack plans.

### LACK OF UTILITY OF PARTIAL DEFENSE

Here I quote Fred Hoffman, who after I gave a talk at UCLA on January 12 chose to take for his example of the utility of a near term, partially effective system, the utility to defend against Soviet nuclear attack when the United States would be using port facilities to load military resupply in case of a large-scale conventional war in Europe.

He wanted to deny the Soviets confidence in achieving their military goals and not deter them by threat of retaliation. But it turned out in the absence of strategic defense, four nuclear weapons would be required; but with a defense of 50 percent effectiveness, eight nuclear

weapons would be required. which hardly exhausts the Soviets' strategic supply of thousands of nuclear weapons.

Dr. Hoffman's answer to this response is that the U.S. President would eventually retaliate with offensive weapons, and he stated that it is the Soviet fear of retaliation which would keep them from attacking in the first place. Deterrence by threat of retaliation is the effective course and Dr. Hoffman's assumed partial defense made no difference in the case he chose to support his thesis.

The easy ballistic missile defense tasks are not worth doing; the hard ones are not judged feasible.

Here I cite the Scowcroft Commission which ends up saying,

> The strategic implications of ballistic missile defense and the criticality of the ABM Treaty to further arms control agreements dictate extreme caution in proceeding to engineering development in this sensitive area.

The Scowcroft Commission appointed by President Reagan January 1983 to study the full scope of strategic weapons and posture judges the ABM Treaty is critical to future U.S. security.

Contrast this with Secretary Weinberger on "ABC News—This Week With David Brinkley"—April 7, 1984—when he said,

> Well, I have never been a proponent of the ABM Treaty. I have never been a proponent of the ABM Treaty. I have never been a proponent of the mutually assured destruction, the MAD theory, the idea that if both sides stopped doing anything about its defense and let themselves be tremendously vulnerable, everything would be all right.

Of course, the capability for mutual assured destruction is not a theory but a fact of life. I and the Scowcroft Commission—and Secretary Weinberger in other sentences—note that our security depends on our ability to penetrate any Soviet defenses, accounting for the Commission's injunction:

> However, no move in the direction of the deployment of active defense should be made without the most careful consideration of the possible strategic and arms control implications.

Then I note that the goal for defending our strategic weapons—when we have given a specific goal—amounted to preserving 200 out of 1,000 Minuteman silos, allowing 800 of these hard-to-destroy silos to be destroyed. Therefore, any defense or combination of defenses which involves local defense of Minuteman silos is a total confession that that defense has no capability to defend the Nation's population or industry, since point defense of soft cities is not possible even to the same extent as a silo, and allowing 800 weapons to land on easy-to-destroy cities will destroy half the U.S. population.

The criterion for a successful defense of silos is to lose fewer than 800 or 900 silos; effective population defense must miss fewer than 20 or 50 incoming warheads.

But how about rendering additional nuclear weapons impotent and obsolete?

In the current wave of revisionist interpretation of the President's vision, some say that a defense would be satisfactory if it reduces the value of further growth in offensive systems.

Paradoxically, defense can increase the value of additional weapons. In a force of 10,000 strategic weapons facing no defense, the first

weapons are applied against the most valuable targets, and the 10,000'th—in order of value—against the least valuable.

In the strategic retaliatory role, the first weapons threaten 500,000 people each—and the industry which they serve—but the last weapons certainly threaten fewer than one ten-thousandth of the population—20,000 people—and probably only 2,000. Thus, declining marginal utility renders additional weapons useful only for bragging, not for using.

But if you deploy a defense, what will happen is that the 10,000 strategic weapons will be retargeted all against the most valuable targets and even the 99-percent effective defense will make an additional weapon more valuable in the presence of defense than it was in the absence of defense.

The argument is spelled out in detail in the material submitted for the record. So it is this kind of effect which underlies the extreme caution advocated by the Scowcroft Commission in doing anything which might imperil the ABM Treaty; it is the reason why I do not in the remainder of this testimony consider anything less than a nearly perfect defensive system.

### PROBLEMS OF PERFECT DEFENSE

The boost-phase intercept is widely regarded as key to advanced systems. General Abrahamson noted that RV's can grow in number and are difficult to verify, and he emphasized boost phase for that reason.

Dr. Gerald Yonas in his testimony on March 1 said, "Nevertheless, directed energy or speed-of-light weapons are on the critical path to a successful capability to counter missiles shortly after they are launched, the boost phase." He says also "A favorable cost exchange is needed to discourage further increases in the number of boosters."

In plain English this says defense should not be considered if it can be overcome at lesser cost—by building more defense, by passive hardening of the booster, by decoys, or by attack on the defense.

In his testimony Edward Teller went so far as to say defensive systems cannot be deployed in space because they can be overcome so cheaply.

The Fletcher panel emphasized survival of space assets, including implications of countermeasures and arms control among the highest leverage aspects for early emphasis.

So little funding has been allotted to invest in studying countermeasures in the last year that it bodes ill for the effective winnowing process, the elimination of nonpromising approaches, that the Defensive Technologies Study Team envisioned.

### COUNTERMEASURES AND VULNERABILITY OF THE DEFENSE

Here is an example of what happens when you don't consider countermeasures.

I have long advocated full development of a terminal defense system for Minuteman silos, and the deployment of 100 as permitted under the ABM Treaty. But I discuss now a truly effective, near-term,

low-cost system for the boost-phase intercept of Soviet ICBM's. True, it doesn't handle SLBM's, but supporters of the SDI often tell me "You have to start somewhere." This system consists simply of a machinegun mounted on a tripod near each Soviet silo, with a gunner at the ready. When the SS–18 or other ICBM is launched, the gunner fires, stitching a row of holes down the side of the missile, reducing its appetite for carrying out its mission. Effective, yes; satisfactory, no; the problem is the total vulnerability of this defense. That is also the problem with many of the approaches considered in the strategic defense initiative.

One of the generic approaches to countering space-deployed defense is the space mine. And it is irrelevant, as put by Dr. Fletcher in his testimony on March 1, 1984, that "Spacecraft may be placed at such depths in space that it may take many hours or even days for space mines to reach them." The space mines are deployed as the satellites go up, and never leave them.

Another vulnerability is that a ballistic missile defense has to be able to handle more than 1,000 boosters launched within seconds and burning out in 40 to 400 seconds.

An antiballistic-missile defense can pick off the individual space defensive stations at leisure, with the satellites unable to maneuver very much.

Other asymmetries aid the offense—x-ray lasers launched with the ICBM's can shoot out from an altitude of 70 kilometers, at which height the atmosphere totally protects them from the attack of a space-deployed x-ray laser, which has spread considerably in reaching the target.

Indeed, a very general counter which totally defeats x-ray lasers for boost-phase attack, as well as the neutral particle beams—hydrogen atoms—for boost-phase intercept, is to have the ICBM's and SLBM's evolve to fast-burn solid boosters, burning out in 40 to 50 seconds and at an altitude of 80 kilometers. A study by Martin Marietta Denver Aerospace presented to the Fletcher panel July 1983 documents this capability for large—MX-size—and small—Midgetman-size—missiles. The cost increase might amount to some 15 percent. Although ultraviolet, visible, and infrared lasers can easily penetrate to 80 kilometers altitude, this fast burn can substantially reduce the number of boosters one could imagine destroying with a space-deployed laser system.

Then I say our standard 25-megawatt laser with a 10-meter diameter optically perfect mirror somewhat bigger than the end of this room, but I don't have time to go into all the details except to note that if the silos were at random and unknown spots on the Earth's surface, 24 lasers would have to be on orbit at 1,000-kilometer altitude in order that one be within range of a given silo. This is the number given in our report as the absentee ratio.

Since the silos are in a known ICBM belt about 4,000 kilometers long, the lasers can be placed in more efficient orbits—spending more time at the latitudes of the silo belt—so that only about eight satellites are needed to have one on station. This difference will be incorporated in later versions of the text. Still, some 800 lasers on orbit are required to handle the 1,400 ICBM's. Each of the lasers will require about 5 tons of fuel, so that at a relatively favorable shuttle cost a single laser

will cost about $15 million to lift the fuel alone in orbit, clearly a poor trade in the face of hardening which could raise the laser requirement by another factor of 10 without significant cost impact on the offense.

Then I discuss kinetic energy kill and conclude that it has no capability against the responsive offense. I discuss ground-based lasers working with orbital mirrors and point out the vulnerability of those mirrors.

Then popup intercepts. A favorite scheme to reduce vulnerability of ballistic missile defense systems is to have them pop up from basing in a secure location. By hypothesis, U.S. territory is totally secure—if these systems work—but basing in the United States for boost-phase intercept requires a mirror or x-ray laser to pop up so far so fast that it may take thousands or even hundreds of thousands of tons of rocket fuel to bring a 1-ton laser or mirror above the curve of the Earth to see the booster while it is still burning.

Boost-phase intercept is attractive because the boosters are fewer than the MIRV's they will eventually deploy, more fragile, and more visible, but it has a terrible problem that it has to take place over Soviet territoy by means of weapons based in space, or popped up, each of which has a serious problem.

In midcourse intercept there are other problems. More time is available over our territory, but now the reentry vehicles can be shrouded in multilaser aluminized plastic balloons that can require 100 shots to get one RV.

In midcourse, since there is no protective atmosphere, other weapons can become effective including the hydrogen-atom beam. Nevertheless, countermeasures abound, including the use of a nuclear explosion in the upper atmosphere to heave enough air to provide a shield against the hydrogen atoms. The atoms are very fragile, easily stripped into protons and electrons, and the charged particles are then swept from the beam by the Earth's magnetic field.

In our report we noted that existing accelerators produce too great an angular spread to make a useful beam, and we proposed to increase the area of the beam—and accelerator—noting that would make the accelerator unacceptably massive for orbital deployment.

Our colleagues at Los Alamos have pointed out that the area could be increased after the beam leaves the small accelerator, reducing the required height. Space station vulnerability remains, however, as does that of ineffectiveness against the heave countermeasures.

Our numbers are only examples, but they do point up the importance of countermeasures as a filter for technologies and systems.

### SOVIET RESPONSE

Now I want to address the likely responses of the Soviet Union to a United States strategic defense initiative program—or the United States to a concerted Soviet strategic defense initiative program.

Secretary Weinberger has said the latter would be a strategic nightmare, and Lt. Gen. Glenn Kent, USAF, retired, has suggested that the Soviets would regard a U.S. ballistic missile defense on a par with an emerging capability to destroy their ICBM's in their silos.

In truth, if we believe at all that one side will obtain a capability to destroy all nuclear weapons before they reach their soil or that of

their allies, the other side is totally disarmed—in a way which cannot be accomplished by destroying silos. Silo attack can always be countered by retaliation—launch after attack—as the Scowcroft Commission puts it in their 1983 report. Therefore, the U.S.S.R. faced with the loss of its retaliatory capability will try to retain it by improving the offensive forces.

Their ballistic missile defense bureaucracy will surely build normal nuclear-armed ballistic missile defense while they try to get a better solution, especially as the United States can have no effective defense from the strategic defense initiative without denouncing the ABM Treaty or forcing the Soviet Union to do so.

Indeed, the ABM Treaty will not be destroyed as a bystander; it is hard to avoid the conclusion that to some it is a primary, near-term target for attack.

RECOMMENDED PROGRAM

Now, you heard that technology exploration and policy and arms control strategic evolution should go together to ensure that we are improving security at every step, but policy and arms control studies cost far less than the $24 billion we are to spend on research and development through 1989 or $100-plus billion we would spend on any hardware.

We really should think first and set national goals later. We can do that, including hardware, at a level of $1 billion or so a year without the vast increases projected over the next 5 years.

In view of the fact that there is no significant opinion that we can soon protect ourselves with an ABM system, and noting the caution of the Scowcroft Commission and the promise of the President that the work of the strategic defense initiative will be done within the confines of the ABM Treaty, I recommend that we urgently negotiate a ban on space weapons along the lines of the treaty I helped introduce to the Senate Foreign Relations Committee May 18, 1983, and which I attach to this testimony.

The Soviet Union introduced in August 1983 to the United Nations a treaty incorporating many of these principles, and beginning with their version would at least ensure that it was acceptable to them.

If some 20 years hence we were convinced that U.S. security would be improved on balance by dispensing with the treaty, that could be done on 6 months' notice.

In the meantime, we would have the benefit of a treaty to limit the threat. The question of verification of such a treaty is addressed in my testimony submitted to this committee April 12, 1984.

I would like to add that perhaps the budget cuts of the House Armed Services Committee for space surveillance could be restored if this program were not part of the strategic defense initiative, but supported by the administration as part of an ASAT treaty verification program. Why don't we look into what we can do in improved techniques for ASAT Treaty verification?

I have curtailed my presentation which will be in the record.

I hope I can answer some questions.

[The prepared statement of Dr. Garwin follows:]

PREPARED STATEMENT BY RICHARD L. GARWIN, IBM, THOMAS J. WATSON RESEARCH CENTER, ADJUNCT PROFESSOR OF PHYSICS, COLUMBIA UNIVERSITY; ANDREW D. WHITE, PROFESSOR-AT-LARGE, CORNELL UNIVERSITY, AND ADJUNCT RESEARCH FELLOW, KENNEDY SCHOOL OF GOVERNMENT, HARVARD UNIVERSITY

Thank you for the opportunity to present my views on President Reagan's Strategic Defense Initiative (SDI). Of course, I speak for myself alone, and not for any of the organizations with which I am affiliated. As is indicated in my attached biography, I have long assisted U.S. administrations in understanding and improving the technical aspects of strategic military capabilities, both offensive and defensive. This includes recent studies for the Department of Defense and the Department of Energy in regard to directed-energy weapons (beam weapons) of various types. Although many of these studies are classified and not generally available, I have given recent testimony to committees of Congress and was also a member of the 9-person study panel responsible for the March 1984 report by the Union of Concerned Scientists, "Space-Based Missile Defense."

The problem with the Strategic Defense Initiative is not a lack of interesting things to do; it is a confusion as to goal, and excessive dedication to the technology. The ancients had a phrase for it: "Having lost sight of our goal, we redoubled our efforts." On March 23, 1984, President Reagan gave us his vision of the future, in which "we could intercept and destroy strategic ballistic missiles before they reached our own soil or that of our allies". He called upon "the scientific community in our country, those who gave us nuclear weapons to turn their great talents now to the cause of mankind and world peace: to give us the means of rendering these nuclear weapons impotent and obsolete."

The President noted in regard to "deterrence of aggression through the promise of retaliation. This approach to stability through offensive threat has worked."

He noted further that "As we pursue our goal of defensive technologies, we recognizes that our allies rely upon our strategic offensive power to deter attacks against them."

The President was "more and more deeply convinced that the human spirit must be capable of rising above dealing with other nations and human beings by threatening their existence."

President Reagan was clearly not talking about defense of missile silos; he was talking about rendering all nuclear weapons impotent and obsolete.

On March 27, 1983 Secretary of Defense Caspar Weinberger echoed and reinforced the President's call:

"Well, the defensive systems the President is talking about are—are not designed to be partial. What we want to try to get is a system which will develop a defense that is—thoroughly reliable and total, yes. And I don't see any reason why that can't be done."

One year later, on March 27, 1984, Secretary Weinberger said, "There has not been any change in direction or change in the ultimate goal. . . . The idea is to have a concentration on a thoroughly reliable, effective defense against these nuclear weapons. And it is, I think, something that can be achieved."

But testimony from Under Secretary of Defense Richard DeLauer and others does not support any promise of a totally effective defense of our nation and our allies. Those working on the program scoff at the idea of an "astrodome defense," of a "defense of whole cities and their populations." They speak instead of introducing uncertainty into Soviet attack plans, and, like Dr. Fred S. Hoffman, head of the Future Security Strategy Study, they speak of the "utility of intermediate systems (offering) a hedge against the possibility that nearly leakproof defenses may take a very long time, or may prove to be unattainable in a practical sense against a Soviet effort to counter the defense."

In the Summary Report of October 1983, Dr. Hoffman speaks of a system which would allow 300 RVs (reentry vehicles) "arriving at targets—sufficient to destroy a very large part of our urban structure and population even if distributed in a nonoptimal fashion from the point of view of the offense. Against an extensive military target system, however, with an attack objective of destroying large fractions of specific target sets . . . with high confidence, such a leakage rate would be totally inadequate for the offense."

Following my talk at UCLA January 12, Dr. Hoffman chose to take for his example a set of port facilities in the United States, where we were loading ships to resupply NATO forces during a conventional war in Europe. He emphasized

that the Soviets could use 4 or 5 nuclear weapons against these ports in the absence of strategic defense and be confident of destroying them, and so isolating the United States from its allies. But with a defense of even 30 percent to 50 percent effectiveness, he claimed that the Soviets could not "be confident of achieving their military goals" and thus would be deterred by inability to achieve their goals rather than by threat of retaliation. Since a restrike to replace the warheads which did not explode at their targets would use about 8 of the Soviet force of 8,000 strategic reentry vehicles, compared with 4 in the case of no defense, one asks why the Soviets could *not* be equally confident in the presence of the assumed defense. Dr. Hoffman's reply is that the U.S. President would retaliate with offensive weapons eventually, and that it is the Soviet fear of that retaliation which would keep them from attacking in the first place. Exactly; deterrence by threat of retaliation is the effective course, and Dr. Hoffman's assumed partial defense made no difference in the case he chose to support his thesis.

The easy BMD tasks are not worth doing; the hard ones are not judged feasible. Strong words, but the Scowcroft Panel reported on April 11, 1983, after the President's speech of March 23, 1983:

"Substantial progress has been made in the last decade in the development of endo-atmospheric and exo-atmospheric ABM defenses. However, applications of current technology offer no real promise of being able to defend the United States against massive nuclear attack in this century. An easier task is to provide ABM defense for fixed hardened targets, such as ICBM silos . . . At this time, however, the Commission believes that no ABM technologies appear to combine practicality, survivability, low cost, and technical effectiveness sufficiently to justify proceeding beyond the stage of technology development."

In their final report of March 21, 1984, the Scowcraft Commission notes that President Reagan endorsed the "integrated strategic program" which it had recommended, and has this to say about ballistic missile defense:

"The Commission was requested to review the Administration's proposals for research on strategic defense. In the Commission's view, research permitted by the ABM treaty is important in order to ascertain the realistic possibilities which technology might offer, as well as to guard against the possibility of an ABM breakthrough by the other side. But the strategic implications of ballistic missile defense and the criticality of the ABM treaty to further arms control agreements dictate extreme caution in proceeding to engineering development in this sensitive area."

The Scowcroft Commission, appointed by President Reagan January 1983 to study the full scope of strategic weapons and posture, believes the ABM treaty is "critical" to future U.S. security. Contrast this with Secretary Weinberger on "ABC News—This Week With David Brinkley":

"Well, I've never been a proponent of the ABM treaty. I've never been a proponent of the mutual assured destruction, the MAD theory, the idea that if both sides stopped doing anything about its defense and let themselves be tremendously vulnerable, everything would be all right."

Of course, the capability for "mutual assured destruction" is not a theory, but a fact of life. I, and the Scowcroft Commission, and Secretary Weinberger in other sentences note that our security depends upon our ability to penetrate any Soviet defenses, accounting for the Commission's injunction:

"However, no move in the direction of the deployment of (any kind) of active defense should be made without the most careful consideration of the possible strategic and arms control implications."

Consider the limited goal of preservation of a small fraction of the 1,000 Minuteman silos against ballistic missile attack. In the 1969 era, Secretary of Defense Melvin Laird and Director of Defense Research and Engineering John S. Foster argued for the deployment of a defense which would preserve 200 of the 1,000 silos against Soviet attack, allowing 800 hardened targets to be destroyed. Any defense or combination of defenses which involves local defense of Minuteman silos is a total confession that the defense has no capability to defend the nation's population or industry, since point defense of soft cities is not possible to the same extent, and allowing 800 weapons to land on easy-to-destroy cities will kill at least half the U.S. population. The criterion for a successful defense of silos is to lose fewer than 800 or 900 silos; effective population defense must miss fewer than 20 or 30 incoming warheads.

But how about rendering additional nuclear weapons "impotent and obsolete"? In the current wave of revisionist interpretation of the President's vision, some say that a defense would be satisfactory if it reduced the value of further growth

in offensive systems. Paradoxically, defense can increase the value of additional weapons. In a force of 10,000 strategic weapons facing no defense, the first weapons are applied against the most valuable targets, and the 10,000th (in order of value) against the least valuable. In the strategic retaliatory role, the first weapons threaten 500,000 people each (and the industry which they serve), but the last weapons certainly threaten fewer than 1/10,000th of the population (20,000 people) and probably only 2,000. Thus, declining marginal utility renders additional weapons useful only for bragging, not for using.

In 1969, the Administration argued for the deployment of a BMD system to protect the Minuteman silos, claiming that a Soviet capability to destroy 90 percent of them (leaving 100 Minutemen) would destroy even our capability for assured destruction. These claims ignored the fact that only about 70 of the 1,000 warheads were targeted on assured-destruction targets, and had we implemented a policy to retarget all surviving Minuteman on assured-destruction targets, a Soviet strike which successfully destroyed 90 percent of the Minutemen would increase the damage the United States would cause by retaliation. In just this way, a partial defense against 10,000 warheads which is 99 percent effective, and which results in retargeting the entire offensive force against assured-destruction targets, allows about 100 warheads to land. An additional warhead would also have about a 1 percent chance of penetrating, and if it did would kill 500,000 people. So the defense and the consequent retargeting would increase the destructive power of an additional warhead from an expected 2,000 deaths to a larger value of 5,000. And this is a 99 percent effective system!

This kind of effect underlies the extreme caution advocated by the Scowcroft Commission in doing anything which might imperil the ABM treaty, and it is the reason why I do not in the remainder of this testimony consider anything less than a nearly perfect ABM system.

### BOOST-PHASE INTERCEPT IS WIDELY REGARDED AS KEY

For instance, Dr. Gerold Yonas, Chairman of the Directed Energy Weapons Panel of the Fletcher Commission stated in his testimony March 1, 1984: "Nevertheless, directed energy, or 'speed of light,' weapons are on the critical path to a successful capability to counter missiles shortly after they are launched, the boost phase."

He says also, "A favorable cost exchange is needed to discourage further increases in the number of boosters."

In plain English, this says that a defense should not be considered if it can be overcome at lesser cost—by building more offense, by passive hardening of the booster, by decoys, or by attack on the defense.

Edward Teller goes so far as to say that defensive systems cannot be deployed in space because they can be overcome so readily—they are costly to put up and cheap to shoot down. Indeed, among the "highest leverage aspects for early emphasis," the Fletcher Panel identified "Survival of space assets" and "Utility and cost exchange assessment, including implications of countermeasures and arms control." Dr. Yonas' testimony states that "As we learn the limits of the technology and the threat response, there will be a constant winnowing process." That means approaches will be dropped as soon as they are found relatively unpromising because of technical, countermeasure, or survivability problems. Unfortunately, our government programs (not only defense) are replete with examples of aversion to face facts, look at Achilles' heels, or even to solve the problem in a low-cost, unexciting way. That so little funding has been allotted to invent and study countermeasures in the last year bodes ill for the effective "winnowing" process the Defensive Technologies Study Team envisioned.

A fine boost-phase intercept system, except . . . I have long advocated full development of a terminal defense system for Minuteman silos, and the deployment of 100 as permitted under the ABM treaty. But I discuss now a truly effective, near-term, low-cost system for boost-phase intercept of Soviet ICBMs. True, it doesn't handle SLBMs, but supporters of the SDI often tell me "You have to start somewhere.' This system consists simply of a machine gun mounted on a tripod near each Soviet silo, with a gunner at the ready. When the SS-18 or other ICBM is launched, the gunner fires, stitching a row of holes down the side of the missile, reducing its appetite for carrying out its mission. Effective, yes; satisfactory, no; the problem is the total vulnerability of this defense. That is also the problem with many of the approaches considered in the SDI.

VULNERABILITY OF SPACE SYSTEMS

One of the general-purpose counters to space-deployed systems is the space mine—a small satellite launched in peacetime and assisted to keep its place always within lethal range of its quarry satellite. The miracle of modern computers and sensors easily allows a very small satellite to do this, and to maintain its position by maneuvering if the quarry maneuvers. Countermeasures such as twin satellites on a 100-km tether would be countered by similar measures on the space mine. It is irrelevant that (as put by Dr. Fletcher in his testimony of March 1, 1984, "spacecraft may be placed at such depths in space that it may take many hours or even days (for space mines) to reach them."

The space mines are deployed as the satellites go up, and never leave them.

A BMD has to be able to handle more than 1000 boosters launched within seconds and burning out in 40–400 seconds. An anti-BMD can pick off the individual space defensive stations at leisure, with the satellites unable to maneuver very much. Other asymmetries aid the offense—x-ray lasers launched with the ICBMs can shoot *out* from an altitude of 70 km, at which height the atmosphere totally protects them from the attack of a space-deployed x-ray laser, which has spread considerably in reaching the target.

Indeed, a very general counter which totally defeats x-ray lasers for boost-phase attack, as well as the neutral particle beams (hydrogen atoms) for boost-phase intercept, is to have the ICBMs and SLBMs evolve to fast-burn solid boosters, burning out in 40–50 sec and at an altitude of 80 km. A study by Martin Marietta Denver Aerospace presented to the Fletcher Panel July 1983 documents this capability for large (MX-size) and small (Midgetman size) missiles. The cost increase might amount to some 15%. Although ultraviolet, visible, and infrared lasers can easily penetrate to 80 km altitude, this fast burn can substantially reduce the number of boosters one could imagine destroying with a space-deployed laser system.

In our UCS "Space-Based Missile Defense" book, we took as an example low-orbit battle stations containing a "standard" chemical laser weapon that produces 25 megawatts (25 MW) for as long as one pleases, and has an optically perfect 10-meter diameter mirror (33-ft.) Since Aviation Week of October 17, 1983 quotes the Fletcher Panel as calling for a 1987 demonstration of a 2-MW laser, our assumption is generous. This standard laser will produce a circular spot having a diameter 1.1 m (area 0.9 sq m) at a range of 3000 km. We assume each booster is vulnerable for 100 sec.

Taking a booster which fails at 20 kilojoules energy on each square centimeter of skin (200 WM-sec/sq m), we see that we need at least 180 MJ, which will require 7 sec output from our laser (perfect tracking, etc.). One such laser, within range, can destroy 14 boosters. At an altitude of 1000 km, such a laser can shoot at silos within a circle having a diameter of 5300 km, so that essentially all 1400 Soviet ICBMs could be reached by a single laser; if all are launched simultaneously however, 100 lasers in view will be required since each can kill only 14 boosters. If the silos were at a random and unknown spot on the earth's surface, 24 lasers would have to be on orbit at 1000-km altitude in order that one be within range of a given silo. (This is the number given in our report as the "absentee ratio.") Since the silos are in a known "ICBM belt" about 5000-km long, the lasers can be placed in more efficient orbits (spending more time at the latitudes of the silo belt), so that only about 8 satellites are needed to have one on station. (This difference will be incorporated in later versions of the text). Still, some 800 lasers on orbit are required to handle the 1400 ICBMs. At about 500 J/gm light output, a 25-MW laser running for 100 sec will require about 5 tons of fuel. At $3 million per ton of payload into orbit, lifting the fuel alone for each laser will cost $15 million—clearly a poor trade for a Midgetman booster, especially if that is further hardened by rapid rotation, ablative coat, and the like, which could raise the laser requirements by another factor of 10 without significant cost impact on the offense.

The "kinetic-energy kill" available from miniature homing vehicles deployed from "space trucks" against boosters have great difficulty handling even current Soviet long-burn ICBMs (aside from their own excruciating vulnerability). They have no capability at all against boosters that burn out at 80 km.

A laser system can be imagined which uses mirrors in space and lasers on U.S. territory. I have sketched such a system using mirrors of 5 m diameter on the ground (the laser telescope), in geostationary orbit at 40,000 km, and several hundred mirrors in low-earth orbit "fighting mirrors" in LEO). Fuel need not be

launched into space, but ways are needed to counter atmospheric turbulence, which would otherwise reduce the beam intensity by a factor 600 or so compared with a space mirror. If the optical system is such that after all this "space billiards" a 0.9 sq m spot is formed on the booster, carrying 25 megawatts of laser light, a laser and its relay mirror in GEO could handle 14 boosters. To obtain 25 MW of light from a uv laser in the atmosphere would require 100–250 MW of light output from the laser. Thus 100 lasers, 100 GEO mirrors, and 100 on-station fighting mirrors would be needed—perhaps 800 fighting mirrors altogether. If the mirrors were retained in orbit, they would be very vulnerable to space mines, x-ray lasers, and the like.

A favorite scheme to reduce vulnerability of BMD systems is to have them "pop up" from basing in a secure location. By hypothesis, U.S. territory is totally secure (if these systems work), but basing in the United States for boost-phase intercept requires a mirror or x-ray laser to pop up so far so fast that it may take thousands or even hundreds of thousands of tons of rocket fuel to bring a one-ton laser or mirror above the curve of the earth to see the booster while it is still burning.

Boost-phase intercept is attractive because the boosters are fewer than the MIRVs they will eventually deploy, more fragile, and more visible.

After boost phase comes post-boost, when the existing MIRV bus deploys one RV after another for 5 minutes or so. The bus can be replaced by a precision ballistic deployment at the end of boost to eliminate any chance of destroying the bus. One is then left with "mid course" intercept of the naked RVs themselves, proceeding to their various targets. The RVs are naked, of course, only when there is no BMD threat—else they can be shrouded in multi-layer aluminized-plastic balloons which look to radar, optics, and heat sensors just like empty balloons which weigh about 1 percent as much, and which can be available to require 100 shots to hit one RV.

In mid-course, other weapons can become effective since there is no protective atmosphere, including the hydrogen-atom beam. Nevertheless, countermeasures abound, including the use of a nuclear explosion in the upper atmosphere to "heave" enough air to provide a shield against the hydrogen atoms. The atoms are very fragile, easily stripped into protons and electrons and the charged particles are then swept from the beam by the earth's magnetic field. In our report we noted that existing accelerators produce too great an angular spread to make a useful beam, and we proposed to increase the area of the beam (and accelerator), noting that would make the accelerator unacceptably massive for orbital deployment. Our colleagues have pointed out that the area could be increased after the beam leaves the small accelerator, saving a great deal of weight. The problem of accelerator and space-station vulnerability remains, however, as does that of effectiveness against the heave countermeasure.

Our numbers are only examples, but they do point up the importance of countermeasures as a "filter" for technologies and systems. Now I want to address the likely responses of the Soviet Union to a U.S. SDI program (or the United States to a concerted Soviet SDI program). Secretary Weinberger has said the latter would be a strategic nightmare, and Glenn Kent (LGEN USAF, ret.) has suggested that the Soviets would regard a U.S. BMD on a par with an emerging capability to destroy their ICBMs in their silos.

In truth, if we believe at all that one side will obtain a capability to destroy all nuclear weapons before they reach their "soil or that of their allies," the other side is totally disarmed—in a way which cannot be accomplished by destroying silos. Silo attack can always be countered by retaliation ("launch after attack") as the Scowcroft Commission puts it in their 1983 report. Therefore, the USSR faced with the loss of its retaliatory capability will try to retain it by improving the offensive forces. Their BMD bureaucracy will surely build normal nuclear-armed BMD while they try to get a better solution, especially as the United States can have no effective defense from the Strategic Defense Initiative without denouncing the ABM treaty or forcing the Soviet Union to do so.

Indeed, the ABM treaty will not be destroyed as a bystander; it is hard to avoid the conclusion that to some it is a primary, near-term target for attack.

### RECOMMENDATION

In view of the fact that there is no significant opinion that we can soon protect ourselves with an ABM system, and noting the caution of the Scowcroft Com-

mission and the promise of the President that the work of the SDI will be done within the confines of the ABM treaty, I recommend that we urgently negotiate a ban on space weapons along the lines of the treaty I helped introduce to the Senate Foreign Relations Committee May 18, 1983, and which I attach to this testimony. The Soviet Union introduced in August 1983 to the United Nations a treaty incorporating many of these principles, and beginning with their version would at least ensure that it was acceptable to them. If 20 years hence we were convinced that U.S. security would be improved *on balance* by dispensing with the treaty, that could be done on 6-month notice. In the meantime, we would have the benefit of a treaty to limit the threat. The question of verification of such a treaty is addressed in my testimony submitted to this Committee April 12, 1984.

[Attachment.]

A TREATY LIMITING ANTI-SATELLITE WEAPONS

ARTICLE I

Each Party undertakes not to destroy, damage, render inoperable or change the flight trajectory of space objects of other States.

ARTICLE II

1. Each Party undertakes not to place in orbit around the earth weapons for destroying, damaging, rendering inoperable, or changing the flight trajectory of space objects, or for damaging objects in the atmosphere or on the ground.

2. Each Party undertakes not to install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

3. Each Party undertakes not to test such weapons in space or against space objects.

ARTICLE III

1. For the purpose of providing assurance of compliance with the provisions of this treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.

2. Verification by national technical means shall be supplemented, as appropriate, by such cooperative measures for contributing to the effectiveness of verification by national technical means as the Parties shall agree upon in the Standing Consultative Commission.

3. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this Article.

4. Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with this treaty.

ARTICLE IV

1. To promote the objectives and implementation of the provisions of this treaty, the Parties shall use the Standing Consultative Commission, established by the Memorandum of Understanding Between the Government of the United States of America and the Government of the Union of Soviet Socialist Republics regarding the Establishment of a Standing Consultative Commission of December 21, 1972.

2. Within the framework of the Standing Consultative Commission, with respect to this treaty, the Parties will:

(a) consider questions considering compliance with the obligations assumed and related situations which may be considered ambiguous;

(b) provides on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;

(c) consider questions involving unintended interference with national technical means of verification, and questions involving unintended impeding of verification by national technical means of compliance with the provisions of this treaty;

(d) consider, as appropriate, cooperative measures contributing to the effectiveness of verification by national technical means;

(e) consider possible changes in the strategic situation which have a bearing on the provisions of this treaty, including the activities of other States;

(f) consider, as appropriate, possible proposals for further increasing the viability of this treaty, including proposals for amendments in accordance with the provisions of this treaty.

ARTICLE V

The Parties undertake to begin, promptly after the entry into force of this treaty, active negotiations with the objective of achieving, as soon as possible, agreement on further measures for the limitation and reduction of weapons subject to limitation in Article II of this treaty.

ARTICLE VI

In order to ensure the viability and effectiveness of this treaty, each Party undertakes not to circumvent the provisions of this treaty, through any other State or States, in any other manner.

ARTICLE VII

Each party undertakes not to assume any international obligation which would conflict with this treaty.

ARTICLE VIII

1. Each Party may propose amendments to this treaty.

2. Agreed amendments shall enter into force in accordance with the procedures governing the entry into force of this treaty.

ARTICLE IX

This treaty shall be of unlimited duration.

ARTICLE X

Each Party shall, in exercising its national sovereignty, have the right to withdraw from this treaty if it decides that extraordinary events related to the subject matter of this treaty have jeopardized its supreme interests. It shall give notice of its decisions to the other Party six months prior to withdrawal from the treaty. Such notice shall include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests.

ARTICLE XI

1. This treaty shall be subject to ratification in accordance with the constitutional procedures of each Party.

2. This treaty shall enter into force on the day of the exchange of instruments of ratification.

ARTICLE XII

1. Done in two copies, each in the English and Russian languages, both texts being equally authentic.

2 This treaty shall be registered pursuant to Article 102 of the Charter of the United Nations.

Senator WILSON [presiding]. Thank you very much, Doctor.

Chairman Warner has had to leave. Let me inquire of both the panel and my colleagues how late they are willing to stay or can stay?

Senator EXON. I have to leave very shortly.

Senator NUNN. I also have to leave in 3 or 4 minutes.

Senator WILSON. Then perhaps what we should do, since you are going to leave at 1 p.m., and I am sure we will have more questions for the record, is suggest to my colleagues that they ask whatever single question is most important to them and the balance we will submit and ask for response for the record.

Senator Exon?

Senator EXON. Gentlemen, I want to thank all of you for your testimony. It has been very well done.

It is very complicated in some respects for those of us not familiar with all of the intricacies of these programs.

Doctor, do I sum up your testimony right in lay terms by simply saying that while you have some misgivings about some of the perceptions of the Strategic Defense Initiative, you feel that we should at least proceed with research and development, if for no other reason than to get us in a posture vis-a-vis the Soviet Union, in which we might reach some kind of accommodation with regard to arms control?

Is that a bottom line summation?

Dr. GRAY. That is very close. We have no prudent alternative than to proceed as we are. Nuclear disarmament down the road may be possible; it may not be.

I do believe deterrence as we have known it in the past several decades can be strengthened through the intermediate kind of capability that the Hoffman report emphasized.

Senator EXON. Thank you.

Dr. Garwin, I listened very carefully and also looked at some of the other testimony that you presented to us.

Do I take it that you dismiss basically out of hand the President's Strategic Defense Initiative, but are in support of some kind of further research on an ASAT system?

Dr. GARWIN. I believe we should do research at a level of $1 billion or $1.5 billion a year on defensive technology, primarily to understand what the Soviet Union might practically accomplish, and confine ourselves to building penetration aids which are, of course, the counter to a Soviet defensive system. If the Soviets deploy tanks, we should design fine antitank weapons to eliminate them if possible. If they deploy a defensive system, we should be ready with penetration aids to nullify that system.

So, I think there is no basis for the President's Strategic Defense Initiative and that this program has been greatly overblown.

No one would advocate a program that increases at that rate without a plan to deploy it if it is successful. After all, what are we hoping for? That it will be unsuccessful?

As for the ASAT, I do believe it is urgent to attack the ASAT problem. That problem is here and now. We can, in my opinion, by not going for a totally comprehensive treaty, which is hardly negotiable and hardly verifiable, but by using the Standing Consultative Commission recommended in the 1983 draft treaty, we can have something which improves our security and which can be adequately verified.

At the same time we should work on development of space mines which would be a way to counter a Soviet strategic defense deployed in space. I believe that we could do that under our proposed treaty because we would not test them.

Senator WILSON. I think we had better go to Senator Nunn.

Senator NUNN. I will yield my time. I have already asked questions.

Senator EXON. Given the inability to come to some kind of agreement on ASAT, do you think we should proceed in that area because of circumstances we are presently facing?

Dr. GARWIN. Absolutely not. I don't think there is inability to come to terms on ASAT. I think there is an unwillingness to recognize that the Soviets have made a proposal and to explore with them the ways in which that proposal does not satisfy our desires.

Senator EXON. Thank you.

Senator WILSON. Senator Bingaman?

Senator BINGAMAN. I have one question to Dr. Garwin.

You made reference in your testimony to the revisionist interpretation of the President's' vision.

I wonder if you can elaborate a little bit as to what you see that revisionist interpretation as being?

Dr. GARWIN. One kind of revisionism is to suggest that the President in asking for means to render nuclear weapons impotent and obsolete was not talking about all nuclear weapons, but only about additional nuclear weapons. So, he would nullify the value of additional nuclear weapons, I don't believe that is what he meant.

One can ask him—although he has been silent on the question since last year. The fact is that the defense does not do that; the additional nuclear weapons have rendered themselves impotent and obsolete by being at the tail end of a large number of them economically applied.

The other kind of revisionism is to suggest that the President did not really mean anything he said, but really wanted to enhance deterrence in some way rather than eliminate the threat of nuclear weapons. I think you have heard it explained that we really are only talking about protecting ICBM's as another way of improving the stability of the strategic balance.

I believe the President has called for a long-range research and development program which is not going to satisfy him in any way unless it has the prospect of eliminating the need to rely on deterrence by threat of retaliation.

Senator BINGAMAN. Thank you very much.

Senator WILSON. Dr. Garwin, you heard Mr. Gray in his testimony indicate certain skepticism about continued reliance upon mutual assured destruction or retaliatory strike as the ultimate deterrence, although he has made clear he feels it is necessary for us to make full use of that as we pursue the defensive strategy.

I would like to allow you to comment on his comment where he thinks that "The nightmare scenario of a desperate Soviet choosing to fight today rather than live with the consequences of a measure of inferiority tomorrow is thoroughly implausible, if not totally ridiculous."

Bear in mind the comment is really based upon this point, "The point should not be missed that the earliest U.S. deployment action in a defensive transition will be for the defense of strategic retaliatory forces and C³I transition."

Dr. GARWIN. Mr. Gray is talking about a defense which is not very effective and so the Soviet Union can tolerate its existence.

I am talking about the defense that the President asked for, one which totally disarms the Soviet Union, one which is so dangerous that the President noted himself on March 23 that the combination of that defense and our offense could be regarded as supporting an aggressive posture.

I say when we tell our allies and the world that we will have a total and perfectly reliable defense against nuclear weapons, the Soviet Union will not let themselves be disarmed.

Imagine what you would do if the Soviet Union were deploying a system that your advisers told you when they finish deploying it, that it would totally disarm the United States, while the Soviets retain a retaliatory capability. We would not strike the Soviet Union. We would first attack that defense as it was being deployed.

We should first look to our penetration aids, but the President is talking about an uncounterable system.

Mr. Gray said the alternative to the Strategic Defense Initiative is not a happy world of superstable, jointly well-managed offensive arsenals. Why not? It is simply because people have not been willing to accept security by threat of retaliation. They have wanted to use nuclear weapons for other purposes, for our power status in the world, for warfighting, for eliminating the other side's ability to retaliate. If we recognize that that is impossible, then we can go to a happy world of superstable, jointly managed offensive arsenals, at least so far as there remain two superpowers. If we can do that, we can get on to the really important questions such as working effectively to bar proliferation of nuclear weapons by other nations.

Senator WILSON. So, you are saying that if our announced policy over a period of years to pursue a defense would be as leakproof as possible, that would be an incentive for the Soviet Union to attack not only the cities, but attack our system?

Dr. GARWIN. They could attack the defenses as they were being deployed. If they failed at that, then before the defense was deployed, they would have to issue an ultimatum.

Senator WILSON. You would disagree with Ambassador Smith that the necessary alternative would be in fact——

Dr. GARWIN. I don't think I disagree with him, but perhaps I missed something. Maybe if you are assuming a perfect defense, which is unattackable, yes, their only response would be in some way to find a way to attack the cities.

That could be by biological weapons or alternative nuclear delivery means. I do believe that a balanced program for population protection, first of all, as Dr. Kerr says, requires civil defense and antiair. You have to price that in. To proceed with this research program without considering the cost of what that would drive us to do in response to easily available alternatives to the Soviet Union is being very shortsighted.

Senator WILSON. How do you square your position with the statement by your colleague, Carl Sagan in his article "Nuclear War" that it would be unimaginable that there would be an attack on cities because that, in his words, would be tantamount to national suicide, he says, even if the attacked nation does not lift a finger to retaliate.

Dr. GARWIN. My happy world of superstable, jointly well-managed offensive arsenals has 1,000 total warheads in the U.S. and Soviet inventories.

Senator WILSON. Let us deal with the real world.

Dr. GARWIN. That is the real world if we recognize the difficulties with the Strategic Defense Initiative, which is not the real world.

What stands in the way of 1,000 on each side is a political question. It is not the ideological contest between the United States and the Soviet Union. It is a domestic, political rivalry in each nation. I think we can solve that problem if we will do what the Scowcroft Commission did—years after these arguments were in the public literature—recognize that Minuteman vulnerability is not of the first moment when there are other strategic forces. There is a great deal of wisdom in that report, and lost opportunity because it came 10 years after those perceptions should have been available to the public and actions taken to implement a better system.

But you could have a credible suicidal threat. In fact, there are many cases in history in which people have either carried out or threatened and deterred attack.

Senator WILSON. Does your alternative then depend on the system you envisage of 1,000 carefully managed warheads on either side?

Dr. GARWIN. Certainly not. We have to live through the next 20 to 30 years, no matter what. If you are anticipating a perfect strategic defense or any kind of strategic defense, it is all the same, you have to get through that era.

I think we ought to be spending that time reducing the offensive threat and reducing the crisis instability which will be a result of excellent defenses on both sides, teamed with offensive weapons.

Senator WILSON. What do you see on the other side, either in terms of their response to arms control initiatives, which one of the earlier witnesses described as Soviet intransigence, and also do you really think they will forebear in proceeding themselves?

Dr. GARWIN. The Soviet Union, except for this Krasnoyarsk radar which would be in violation of an ABM Treaty, if turned on, has abided by the terms of the ABM Treaty. They have offered an arms control agreement—on space weapons—which we have paid no attention to at all.

I would not regard them as intransigent in the arms control arena. It is not intransigent to reject a treaty which is totally one sided. It is very easy for us in this room to decide on a treaty which serves American interests. We staple together the wish list with a strategic defense initiative wish list of the services and then we have something to go to the Soviet Union. They reject it and we say intransigence.

That is no way to negotiate.

Senator WILSON. Do you think it is intransigence to reject onsite inspection?

Dr. GARWIN. Not when it is not useful, when we know it will stand in the way of an effective treaty. On some things onsite inspection is desirable. In some cases it is less useful than national technical means or cooperative means.

We would not be very happy for onsite inspection in this country. If you notice under the chemical treaty we offer onsite inspection

under certain circumstances, but that means you don't get into a chemical manufacturing plant unless it is working for the Government.

Senator WILSON. How much of your concern is generated by the thought there can be effective alternative means in offensive weapons?

Dr. GARWIN. Quite a lot. It is like the Economics-I illustration of what would this country be without railroads. We wouldn't be without transportation. We would have canals, and they would not cost much more.

In a world in which there are hardly any suitcase bombs, in a world in which there are no bombers on the Soviet side, and very few existing intercontinental cruise missiles, it is hard to conceive that when you have an effective ballistic missile defense, you would get all these other threats; but the economics, the cost of the individual elements has to change only a little bit to make a major change in the force structure on their side. A defense against ballistic missiles is just such a change in relative costs.

Of course, you must introduce that question and it is important; but even in the ballistic missile arena I don't see right now how we can win a race with the offensive countermeasures. That is what we should do a little bit of studying on.

The demonstration programs that are proposed are very expensive and get in the way of thinking. In my opinion, they are more for engendering public support than they are for assuring technical progress in the program.

Senator WILSON. Dr. Garwin, is the idea that I have attributed to you in some of the reports accurate that you think that the alternative mutual deterrence, will be emplacing weapons on the Soviet territory?

Dr. GARWIN. I proposed that in 1969 so that people should sharpen their thinking, but that has to be done by agreement. There is something to it.

If you are going to have the Soviet Union vulnerable to our weapons in order to have a deterrence, then why not, if they are willing, emplace nuclear weapons on their territory so long as the weapons are invulnerable and totally controlled by us.

From that point of view I think you would probably favor our emplacing weapons on Soviet territory. If the Soviet Union comes to us with the same sort of approach, recognizing the fact of vulnerability, we might even accede. It does not have to be bilateral; it could be unilateral.

However, I think it will be a long time before we get to such a low-cost approach. I think we would be better off to retain the present offensive arms while moving to the Midgetman, to the small submarines as recommended by the Scowcroft Commission, and preserving the ABM Treaty.

Senator WILSON. Gentlemen, we are running over, but I cannot resist affording Mr. Gray the opportunity to respond to Dr. Garwin's criticisms.

Mr. GRAY. Responding to Richard Garwin is a challenge.

The Scowcroft Commission report of last year also contained a startling direct statement that Dick may regard as revisionist, when the authors of the Commission report said deterrence requires military effectiveness.

Relatively small nuclear arsenals that can serve no militarily useful purpose would indeed go to the heart of destroying NATO strategy and the western alliance as we currently know it.

The kind of deterrence that Dick Garwin has been talking about is deterrence that could not serve our overseas interests. It so happens that for reasons of geography the United States has a residual limited first use requirement placed upon its strategic nuclear force to provide compensation for the missing conventional tactics, forces, placed around Eurasia to withstand Soviet attack.

Nuclear mines in place, or similar ideas, are not the kind of nuclear forces that we could threaten credibly to employ in order to support our overseas security interests as required in the flexible response doctrine of NATO MC–14/3 of 1967, which still happens to be the authoritative document.

Successive U.S. Governments of both parties have believed that credible, or not incredible, war fighting options, with no guarantee that nuclear war could indeed be waged with flexibility, nonetheless threats that speak to Soviet anxieties which would have some military effectiveness against the Soviet ability to wage war, go to the heart of what deterrence is about.

NSDM–242 in the Nixon administration, PD–59 of the Carter administration, NSDD–13 of the Reagan administration, stress the fact we really need to target those kinds of Soviet assets. If we cannot do much damage to the Soviet homeland—if we do not believe we can and they do not believe we can—how then do we fulfill our alliance obligations?

How do we discourage Soviet intervention? That is an interesting question.

It is several decades away from policy matters that concern us today, but it is a valid concern.

I would like to endorse what Dick Garwin said earlier about the value of thinking. For a long time we have had adequate time to get our policy act together, to consider what residual role we may wish to assign to offensive forces, to consider how to go about putting together near-term and far-term arms control strategy.

I think there is a need for a more coherent policy story to be presented. Certainly thinking is a lot cheaper than developing, testing, and deploying. I think we have time to do it. The business is well underway.

I have considerable fundamental differences with Richard Garwin as to the theory of deterrence, what is feasible and what is not. The notion of the Soviet Union sitting back and acquiescing in strategic balance is not the Soviet Union we know. It is not the Soviet Union with the Russian history they have behind it.

The Soviets have an inalienable commitment to the protection of their homeland. The idea of Soviet acquiescence in our ability to inflict minimal, but nevertheless substantial damage on people, is a very un-Soviet concept.

Dick Garwin's idea might be appropriate if we were dealing with a rather different adversary. The Soviet Union we know today is not the Soviet Union that is going to acquiesce in Dick Garwin's vision of a more stable future.

Dr. GARWIN. Maybe we should find out more about the Soviet Union in another hearing. My thousand weapons are fully capable of striking Soviet Army divisions and would be used that way in the first place.

Senator WILSON. I, for one, will be delighted to have a second session. I think we will probably have many more.

You have been generous with your time this morning. I thank you on behalf of all my colleagues.

Thank you. The subcommittee is adjourned.

[Whereupon, at 1:13 p.m., the subcommittee adjourned, subject to the call of the Chair.]

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